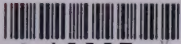


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SIERRA 413,413A1 MAINTENANCE MANUAL

SIERRA 413A

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MP MASTER



MA29780

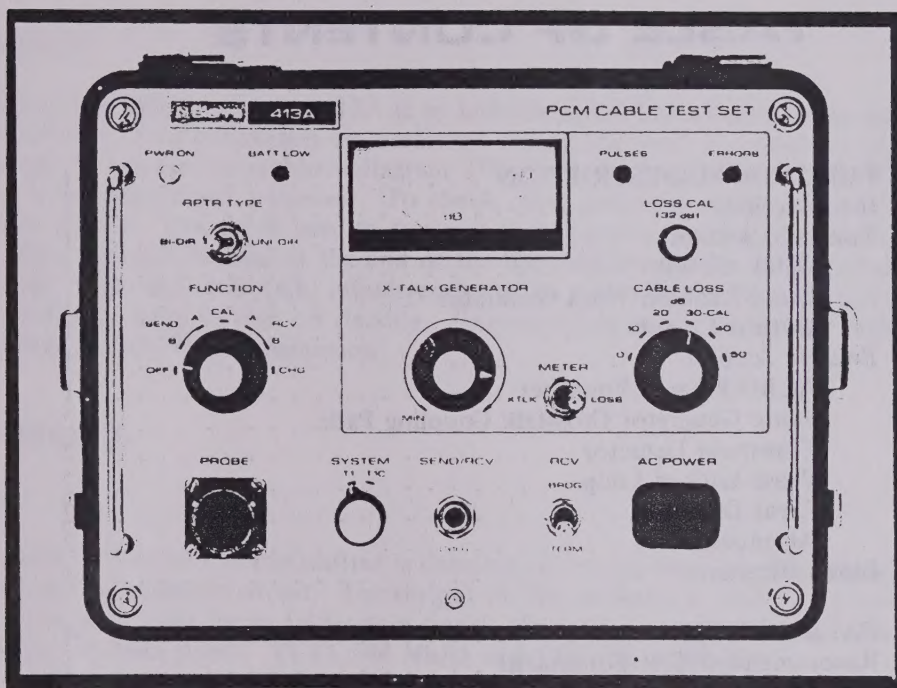


Fig. 1-1 — 413A PCM Cable Test Set

This Maintenance Manual provides information for service and calibration center use. It is suggested that the instrument be calibrated on an annual basis, depending upon conditions and user requirements.

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1. FUNCTIONAL DESCRIPTION

INTRODUCTION

1.01 The principle function of the 413A is to test the suitability of cable pairs used in PCM transmission. Two parameters are measured during the test: transmission loss and crosstalk margin. The functional block diagram (Fig. 1-2) shows that the instrument is composed of a transmitter and a receiver. To check cable pairs, one set is needed at each end of the repeater section. One set is used to transmit quasi-random bipolar pulses over the cable under test. The other set, located at the end of the line, will receive the distorted signal. A simulated NEXT (near end cross talk) interference can be added to the incoming signal without causing the ERRORS lamp to turn on steadily. Excessive loss in the cable pairs indicates that they are not suitable for PCM transmission.

TRANSMIT SECTION

Clock Circuit

1.02 The PCM bit rate of the transmitter is determined by the resonant frequency of the crystal in the oscillator circuit. The output of the oscillator is used as a clock to drive the digital I.C. in generating the quasi-random signal. Two clock frequencies are available and are selectable at the front panel: T1 (1.544 Mb/s) and T1C (3.152 Mb/s).

Quasi-Random Word Generator

1.03 The quasi-random word generator is composed of a 20-stage shift register with feedback at the 17th and 20th stage. The length of the word is $2^{20} - 1$ bits with equal number of 1 and 0 occurring in a random manner. An additional circuit is provided to guarantee that the output will not generate more than 14 zeros in a row. This pattern simulates the signal from an active channel terminal.

Output Circuit

1.04 The output circuit converts the unipolar signal at the QRW generator output into a bipolar signal. The amplitude of the output square waveform is regulated by a voltage regulator. The transformer provides a balanced output as well as high voltage protection for the output circuit.

RECEIVE SECTION

ALBO Preamp/Equalizer

1.05 The equalizer, also known as the automatic line build out (ALBO) is composed of several sections of RLC network. The transfer function of this network has two zeros whose locations on the complex s-plane are controlled by the dynamic resistance of the diodes connected to the ALBO circuit. The peak detector of the AGC circuit in the signal channel

detects the peak amplitude of the input signal and forces the error amplifiers to put out some amount of current to change the dynamic resistance of the diodes in order to maintain the output of the signal channel pre-amplifier at a constant amplitude. The same AGC current is also used to drive the ALBO in the reference channel whose input is a fixed level single tone with frequency equal to half of the system frequency. Since the two pre-amplifiers are driven by the same AGC current, their gains are expected to be equal. The output of the reference channel pre-amplifier is therefore proportional to the loss of the input signal at half of the system frequency.

Noise Generator Crosstalk Coupling Path

1.06 The noise generator produces a wide spectrum white noise signal shaped to simulate NEXT characteristics. The 4.5 dB/octave coupling characteristic is incorporated into the shaping filters. The local noise (reference) and the cable noise are summed by the summing amplifier. The meter displays the result of this operation in dB. The output of the summing amplifier is low-pass filtered before entering the threshold detector.

Threshold Detector

1.07 The threshold detector sets a fixed threshold at half the input amplitude in order to provide a minimum probability of error during detection. The output is sampled, and the error detector will indicate any bipolar violations.

Phase-Locked Loop

1.08 The phase-locked loop is used as a clock regenerator in producing the sampling clock pulse for the error detector. The input signal is first differentiated and then rectified in order to recover the spectral component at the bit rate frequency to reduce capture time. The PLL can be switched to a different free running frequency by changing the RC time constant of the VCO (voltage-controlled-oscillator). The output of the PLL is also used as an input to the reference channel pre-amplifier. A J-K flip-flop is needed to achieve the divide-by-two function while a low pass filter is used to extract the single tone.

Error Detector

1.09 The error detector samples the threshold detector output at every clock pulse interval. A "pulse stretcher" is activated if a bipolar violation occurs, ensuring sufficient duration to cause the lamp to visibly flash. The ERRORS lamp will be on steadily if the number of errors is higher than its flash rate.

Note: At 1.544 Mb/s (T1), one flash in 1 second indicates performance of about 10^{-6} . One flash in seven seconds indicates performance of about 10^{-7} . For other bit rates, divide the bit rate by 1 million for "flashes per second" requirement at 10^{-7} . (See also 2.36 in the Operation Manual for additional discussion of Flashing Rate.)

Attenuator

1.10 The 50 dB attenuator simulates an artificial line in the RECEIVE and CAL modes. In the CAL mode, the attenuator is used to calibrate the receive signal to 32 dB. The CABLE LOSS switch sets signal attenuation in 10 dB/step.

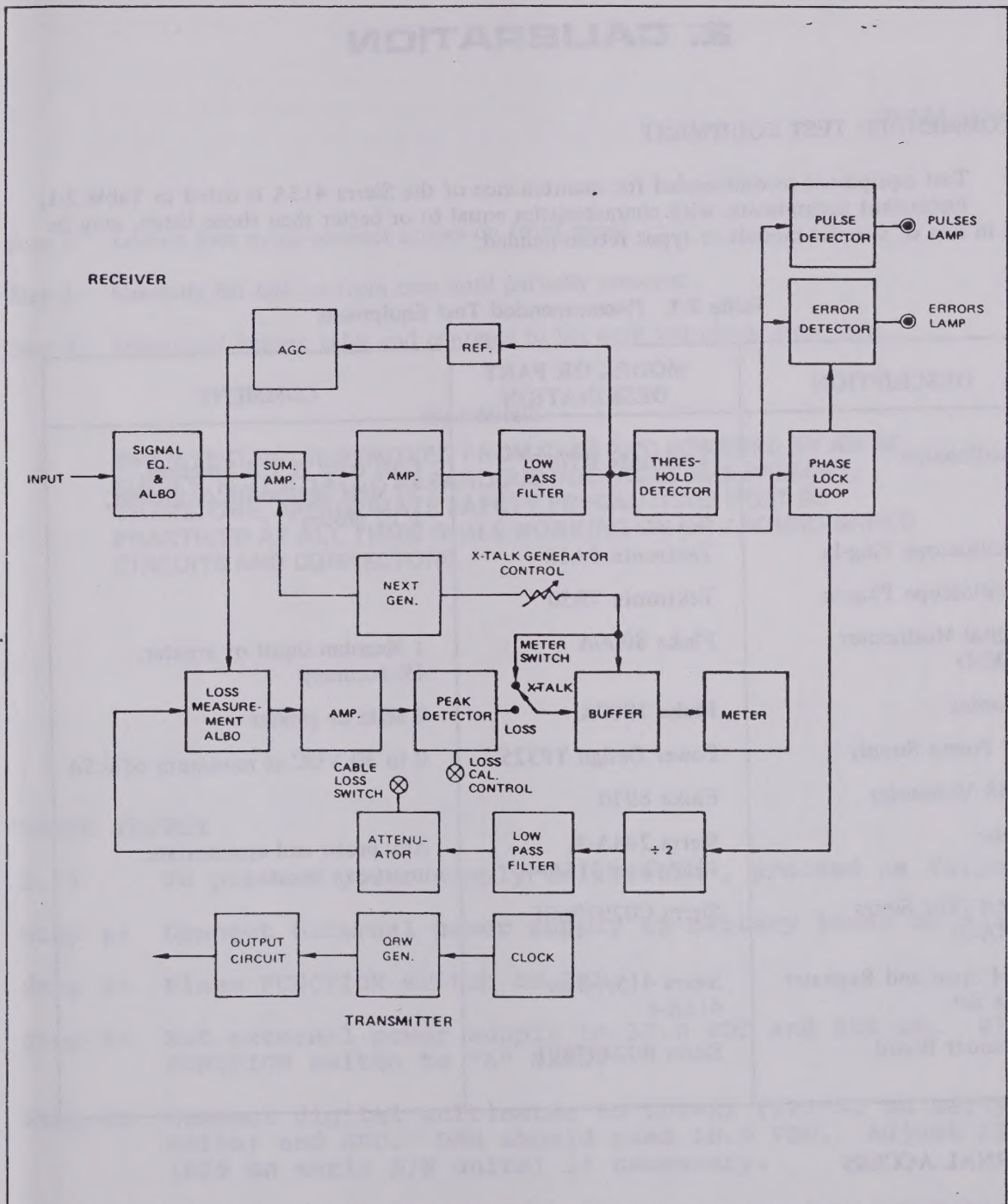


Fig. 1-2 – 413A Functional Block Diagram

2. CALIBRATION

RECOMMENDED TEST EQUIPMENT

2.01 Test equipment recommended for maintenance of the Sierra 413A is listed in Table 2-1. Equivalent instruments, with characteristics equal to or better than those listed, may be used in lieu of specific models or types recommended.

Table 2-1. Recommended Test Equipment

DESCRIPTION	MODEL OR PART DESIGNATION	COMMENT
Oscilloscope	Tektronix R7603	Dual trace A + B function, 50 MHz bandwidth or greater, x 10 probes
Oscilloscope Plug-In	Tektronix 7A18	
Oscilloscope Plug-In	Tektronix 7B50	
Digital Multimeter (DMM)	Fluke 8000A	1 Megohm input or greater, 1% accuracy
Counter	Fluke 1900A	2 MHz or greater
DC Power Supply	Power Design TP325	0 to 30 VDC at minimum of 0.5A
RMS Voltmeter	Fluke 8920	
Probe	Sierra 244A-3, 415A-2 or 415A-4	Any probe and appropriate insert can be used
Insert (For Sierra 415A-2)	Sierra C02979601	
PCM Span and Repeater Test Set	Sierra 415A-2 or 415A-4	
Extender Board	Sierra B02447801	

INTERNAL ACCESS

2.02 For access to internal parts of the 413A and to various test points on PCB's, remove the instrument from its metal case as follows:

Step 1: Remove case carrying cover and verify POWER switch is in OFF position. If AC power cord is connected, disconnect.

SIERRA 413A

- Step 2: Loosen four quick-connect screws on front panel.
- Step 3: Carefully lift test set from case until partially removed.
- Step 4: Disconnect battery cable and continue to lift until instrument clears case.

WARNING

WHEN TEST SET IS REMOVED FROM CASE AND POWERED BY AN AC SUPPLY, POTENTIALLY HAZARDOUS VOLTAGES ARE PRESENT; THEREFORE, APPROPRIATE SAFETY PRECAUTIONS MUST BE PRACTICED AT ALL TIMES WHILE WORKING ON OR AROUND BARED CIRCUITS AND CONNECTORS.

POWER SUPPLY

2.03 To perform power supply calibration, proceed as follows:

- Step 1: Connect external power supply to battery leads on 413A.
- Step 2: Place FUNCTION switch to CAL.
- Step 3: Set external power supply to 17.0 VDC and 500 mA. Place FUNCTION switch to "A" SEND.
- Step 4: Connect digital multimeter to TP1-A1 (TP3-A1 on early S/N units) and GND. DMM should read 10.0 VDC. Adjust R22-A1 (R25 on early S/N units) if necessary.
- Step 5: Connect DMM between GND and voltage regulator LM340 (VR2 pin) located on the power supply panel. DMM should read 5.0 VDC $\pm$ 0.2 VDC.

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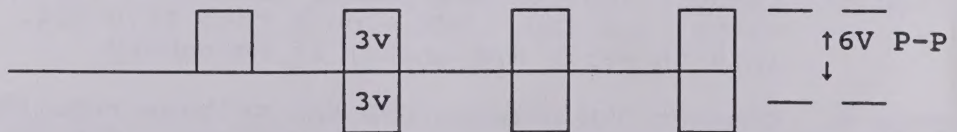
- Step 6: When slowly decreasing supply voltage to 12.8 VDC. BATT LOW lamp on front panel of unit under test should flash. If not, adjust R2-A1 (R15-A1 on early S/N units) until lamp just starts to flash.
- Step 7: Lower power supply voltage to 12.0 VDC. BATT LOW lamp should now be continuously illuminated.
- Step 8: Remove external power supply and apply A/C power. Connect ammeter across batt. leads and observe a current reading of $425 \text{ mA} \pm 25\text{mA}$.
- Step 9: Re-connect battery leads.

QUASI-RANDOM WORD GENERATOR AND SEND FUNCTIONS

2.04 To calibrate QRW generator and send functions, proceed as follows:

- Step 1: Set 413A control as follows:
RPTR TYPE switch to UNI-DIR
FUNCTION switch to SEND A
METER switch to LOSS
SYSTEM switch to T1
RCV BRDG/TERM switch to TERM
- Step 2: Insert a 310 plug with a 100-ohm resistor Tip to Ring in SEND/RCV jack.
- Step 3: Connect channel 1 and channel 2 probe of scope across the 100-ohm resistor.
- NOTE: Channel 2 must be inverted from channel 1 and the MODE switch set to ADD.
- Step 4: Adjust R9-A2 for 6.0V peak-to-peak $\pm 0.1\text{V}$.

Example:



- Step 5: Check SEND A on BI-DIR Side 1 and SEND B on BI-DIR Side 2, UNI-DIR Side 2. Check that results are the same as in Step 4.

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Step 6: Set the 415A controls as follows:

PULSE PERIOD switch to REF
REPEATER TEST switch to UNI-DIR (B) side 1
FUNCTION switch to QRSS
STOP XMT, NORM, XMT ERRORS switch to NORM

Step 7: Place appropriate insert into 415A insert slot.

Step 8: Remove the 310 plug with a 100-ohm resistor from the SEND/RCV jack.

Step 9: Connect probe between 413A and insert in 415A.

Step 10: Turn 415A POWER switch to LAMP TEST. Ensure all lamps light. Turn POWER switch ON. Proceed with ALBO adjustments.

ALBO

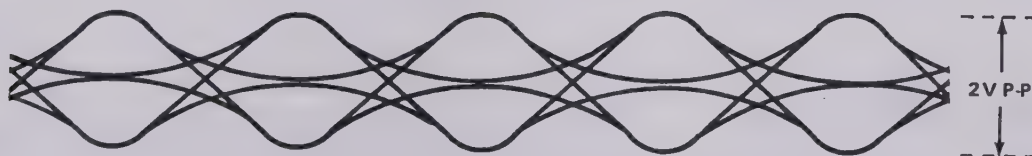
2.05 Adjust ALBO as follows: (Check meter circuit accuracy before making any adjustments.)

Step 1: Place 413A FUNCTION switch to RCV A.

Step 2: Connect channel 1 probe from scope to TP1-A4. (TP2 on early S/N's units)

Step 3: Adjust R56-A4 (R30 on 413A1) so that eye-amplitude just REACHES maximum approx. 2.0 V.

Example:



Step 4: Place 415A SYSTEM Mb/s switch to 3.152 and 413A SYSTEM switch to T1C.

Step 5: Adjust R54-A4 (R31 on 413A1) for maximum eye-opening and amplitude.

Step 6: Disconnect scope probe from TP1-A4.

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ERROR DETECTOR SAMPLING TIME

(Perform Steps 6 thorough 8 before making any adjustments.)

2.06 To calibrate error detector sampling time, proceed as follows:

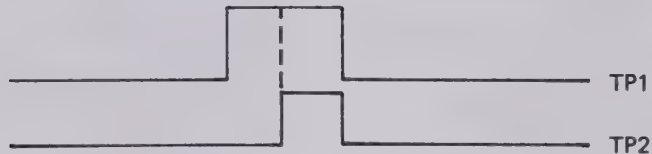
Step 1: Place 415A SYSTEM Mb/s switch to 1.544 and 413A SYSTEM switch to T1, art line to 31, and function to all ones.

Step 2: Connect scope probe channel 1 to TP1-A3 and channel 2 to TP2-A3.

Step 3: Adjust R21-A3 per example below.

Step 4: Place 415A SYSTEM Mb/s switch to 3.152 and 413A SYSTEM switch to T1C.

Step 5: Adjust R-20-A3 as per example below. (Example is for all 1s function.)



Step 6: Verify PULSES lamp is ON and ERRORS lamp is OFF.

Step 7: Disconnect both scope probes.

METER CIRCUIT

2.07 Perform meter circuit adjustments as follows: (Check meter circuit accuracy before making any adjustments.)

Step 1: Place 415A SYSTEM Mb/s switch to 1.544 function to QRSS and 413A SYSTEM switch to T1, function to RCV A.

Step 2: Set 415A ART LINE dB switch to 40.

Step 3: Set 413A CABLE LOSS switch to 40 and RCV to term.

Step 4: Set 413A LOSS CAL pot for a zero dB reading on the 413A meter.

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- Step 5: Set 413A CABLE LOSS switch to 30.
- Step 6: Adjust R38-A3 (as R22 for 413A1) for a 413A meter reading of 10 dB.
- Step 7: Repeat steps 3-6 until meter reads exactly zero and 10 for the two positions of the CABLE LOSS switch.
- Step 8: Rotate 415A ART LINE dB switch from 5 through 43 and verify that the 413A meter readings are within ± 1 dB of 415A ART LINE dB switch positions.
- Step 9: Set 415A SYSTEM Mb/s switch to 3.152 and 413A SYSTEM switch to T1C.
- Step 10: Set 415A ART LINE Mb/s switch to 24 and 413A CABLE LOSS switch to 30.
- Step 11: Adjust R37-A3 (as R23 on 413A1) for a 413A meter reading of 35.5 dB.
- Step 12: Set 415A ART LINE dB switch from 5 through 33 and verify that the 413A meter readings are within ± 1 dB of those in Table 2-2.

TABLE 2-2 413A (413A-1)

<u>415 ART LINE dB Switch Settings</u>	<u>413A (A1) Meter Readings (Using 415A4) within ± 1 dB</u>	<u>413A (A1) Meter Readings (Using 415A2) within ± 1 dB</u>
5	7	10
24	35.5	34
33	49	46

- Step 13: Set 413A FUNCTION switch to CAL and adjust R64-A7 for a 413A meter reading of 32 dB.
- Step 14: Set 413A SYSTEM switch to T1 and adjust R66-A7 for a 413A meter reading of 32 dB.

RCV FUNCTION

- 2.08 Perform RCV function tests as follows:

SIERRA 413A

- Step 1: Set 415A ART LINE dB switch to 24 and REPEATER TEST switch to UNI-DIR side 1.
- Step 2: Set 413A RPTR TYPE switch to UNI-DIR, FUNCTION switch to RCV A, METER switch to LOSS, CABLE LOSS switch to 20, SYSTEM to T1.
- Step 3: Verify a 413A meter reading of 24.1 ± 0.1 .
- Step 4: Verify PULSES lamp is ON and ERRORS lamp is OFF. Set 415A RPTR TEST switch to UNI-DIR side 2 and 413A FUNCTION switch to REC B. Level should read the same as in Steps 1 and 2.
- Step 5: Set 415A RPTR TEST switch to BI-DIR side 1.
- Step 6: Set 413A RPTR TYPE switch to BI-DIR and verify same as Steps 3 and 4 above. Repeat Steps 3 and 4 with the 415A RPTR TEST switch set to DI-DIR side 2, and the 413A FUNCTION switch set to RCV B. Level reading should be the same in both cases.
- Step 7: Place 413A REC switch to "BRDG" and note meter reading increases ~6 dB. Return REC switch to "TERM."

CROSSTALK

2.09 Perform Crosstalk adjustments as follows:

- Step 1: Turn X-TALK GENERATOR Vernier on 413A fully CCW. (Step control at 70 for 413A1.)
 - Step 2: Set FUNCTION switch to CAL.
 - Step 3: Set METER switch to X-TALK.
 - Step 4: Adjust R51-A5 (R35 for 413A1) board for zero on 413A meter.
 - Step 5: Turn X-TALK GENERATOR control and verify that a full scale reading on the 413A meter can be reached.
 - Step 6: Adjust X-TALK GENERATOR for an 8 dB (2dB for 413A1) meter reading on the 413A meter.
 - Step 7: Adjust R6-A7 board so ERRORS lamp flashes about 1 flash per second.
 - Step 8: Set System switch to T1C and adjust R14-A7 board so ERRORS lamp flashes about 1 flash per second.
- NOTE: RZ A7 (R1 A7 for 413A1) controls overall X-TALK output for both T1 and T1C.

3. TECHNICAL DATA

SPECIFICATIONS

3.01 Specifications are shown in Table 3-1.

Table 3-1. 413A Specifications

PARAMETER	CHARACTERISTICS
TRANSMITTER	
Output Signal:	Bipolar, QRW
Bit Rates:	1.544 Mb/s (T1), 3.152 Mb/s (T1C)
Word Pattern:	1.048 Mb quasi-random; T1 has 14 zero suppression
Pulse Amplitude:	$\pm 3V \pm 5\%$ base-to-peak
Overshoot:	None
Duty Cycle:	50% $\pm 5\%$
Output Impedance:	105 ohms
RECEIVER	
Input Signal:	T1 or T1C
Input Range:	(3V peak-to-peak reference)
T1	6 to 40 dB (at 772 kHz)
T1C	8 to 54 dB (at 1.576 MHz)
Meter Accuracy:	
T1	± 1 dB
T1C	± 1 dB (8 to 50 dB range) ± 2 dB (50 to 54 dB range)
Crosstalk Generator Signal:	PCM-shaped white noise
Meter Scale:	0 to 10 dB
Input Impedance	
Terminated	105 ohms
Bridging	>2000 ohms
ENVIRONMENT	
Operating:	0 to 50°C without sun loading Maximum humidity 95%
Non-Operating:	-20 to +65°C
PHYSICAL	
Dimensions:	8 in (19 cm) H x 12 in (31 cm) W x 9 in (21 cm) D (cover removed)
Weight:	18 lbs (8 kg) (including batteries and probe)
POWER	
AC Input:	115/230 VAC $\pm 10\%$ (for operation or recharging)
Batteries:	15 VDC, 4 A-Hr, rechargeable pack
Battery Life:	40 hours normal operation
Charging Time:	14 hours nominal

ORDERING INFORMATION

3.02 The 413A is equipped with a web belt carrying strap and a removable 115 VAC power cord. Earlier models of the 413A were shipped with 12 separate rechargeable batteries (918500005). Later models are supplied with a rechargeable NiCad battery pack (C03295600). Optional accessories are listed in Table 3-2. (The specific probe to be used is determined by the type of repeater to be tested.)

Table 3-2. Accessories

PART NUMBER	APPLICATION
242B	Probe - Vicom 1550, ITT, and Similar (Requires Adapter Cable)
242C	Probe - ITT "T1" and "T148" (Requires Adapter Cable)
243A-4	Patch Cable, 310 Plug to Alligator Clips
244A-1	Probe - T1C (WEC0 248/249)
244A-2	Probe - Standard T1 (WEC0 201/205)
244A-3	Probe - Mini T1 Repeaters (WEC0 238/239)
246A-3	Probe - WEC0 217A (SLC 40)
C03256000	Adapter Cable (required for 242B and 242C Probes)
921000076	Canvas Carrying Case

4. SCHEMATICS AND PARTS LISTS

4.01 Following is a list of 413A schematic diagrams and parts lists included in this section.

Drawing Number	Description
D03267000	Interconnect Diagram
D03266200	A1 Power Supply
D03266300	A2 Pseudo-Random Word Generator
D03266400	A3 Clock Regenerator Circuit
D03266500	A4 ALBO
D03266600	A5 Meter Circuit
D03266700	A6 Mother Board
D03266800	A7A NEXT And Clock Generator
D03276200	Final Assembly
D03276400	Front Panel Assembly
D03276800	Power Supply Panel

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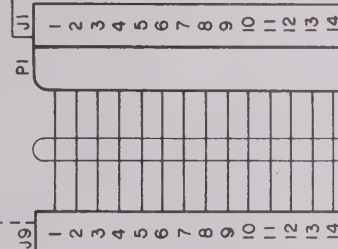
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A7A

N.E.X.T. AND CLOCK GEN
ASSY A03265400
SCHEM D03266800

A5

METER CIRCUIT
ASSY A03264600
SCHEM D03266600

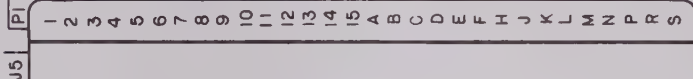


PI

J9

PART OF
A6

MOTHER BOARD
ASSY A03265000
SCHEM D03266700



PI

J9

C



PI

J2

PI

POWER SUPPLY
ASSY A03263000
SCHEM D03266200

A1

PSEUDO RANDOM WORD GEN
ASSY A03263400
SCHEM D03266300

A2



PI

CLOCK
ASSY
SCHEM

A3

B

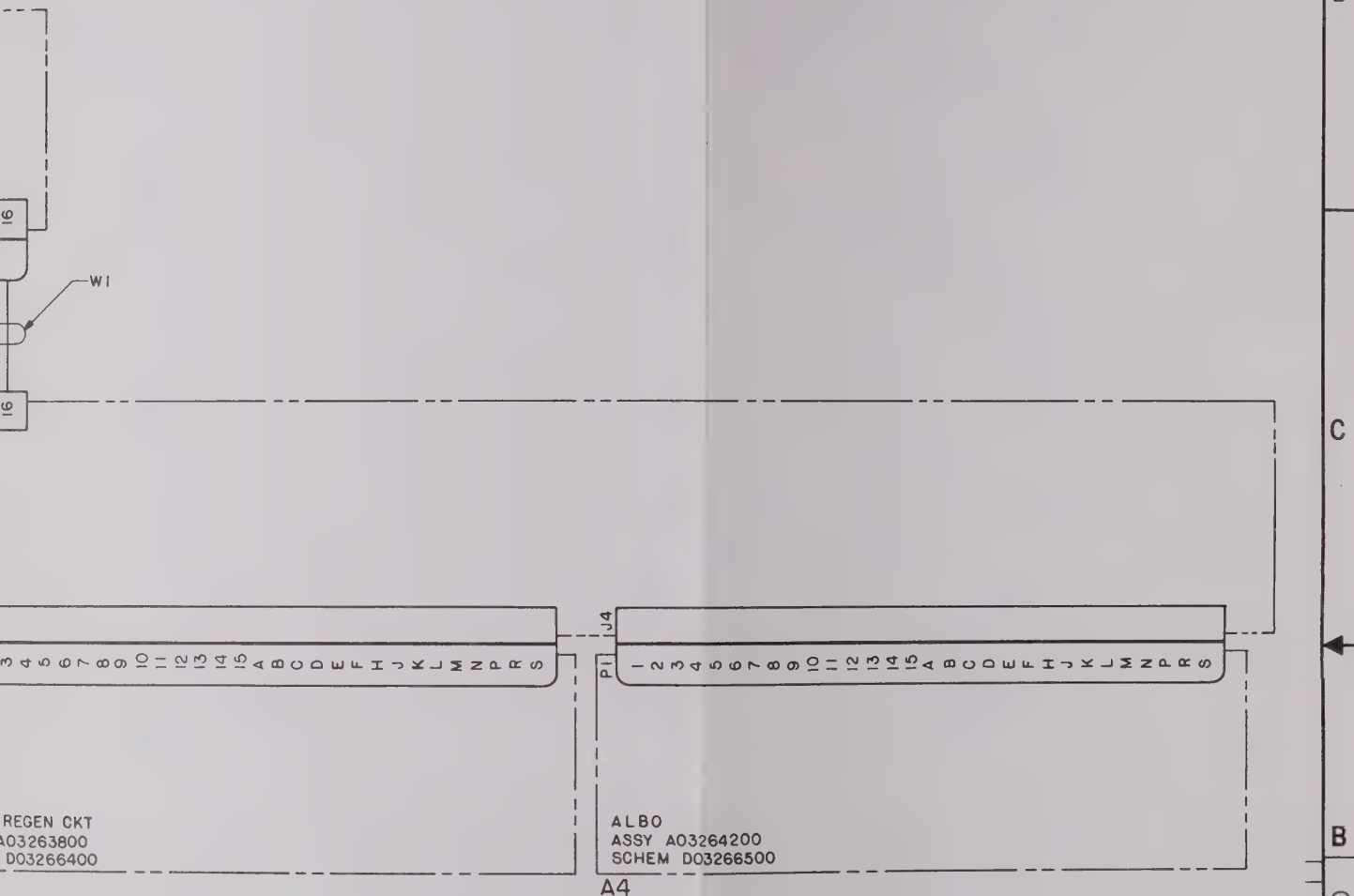
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NOTES - UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER, ASSEMBLY DESIGNATION OR BOTH
2. ALL RESISTANCE VALUES ARE IN OHMS
3.  DENOTES FRONT PANEL MARKING

QTY. QTY. QTY. QTY.				ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE						
						LIST OF MATERIAL OR PARTS LIST								
ALL THREADS UNIFIED EXTERNAL THREADS TO BE CLASS 2A; INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED				☒ FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.		DO NOT SCALE DWG.		 Sierra LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION MENLO PARK, CALIFORNIA 94025	CODE IDENT. NO. 54778					
						DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.								
						TOLERANCE UNLESS SPECIFIED		INTERCONNECT DIAGRAM 413A						
						<table border="1"> <tr> <td>BASIC</td> <td>TWO PLACES</td> <td>THREE PLACES</td> </tr> <tr> <td>UP TO 6</td> <td>± .02</td> <td>±</td> </tr> <tr> <td>6 TO 24</td> <td>± .03</td> <td>±</td> </tr> <tr> <td>ABOVE 24</td> <td>± .06</td> <td>±</td> </tr> </table>			BASIC	TWO PLACES	THREE PLACES	UP TO 6	± .02	±
BASIC	TWO PLACES	THREE PLACES												
UP TO 6	± .02	±												
6 TO 24	± .03	±												
ABOVE 24	± .06	±												
				413A		DATE <u>8/22/77</u>	SIZE	DRAWING NO.	REV.					
ASSY. QTY. NEXT ITEM				NEXT ASSY. MODEL NO.		BY <u>J. Lopez</u> CHECKED <u>9/6</u> APPR <u>8/15/82</u>	D SCALE	D03267000 STOCK AS	C SHEET 1 OF 3					

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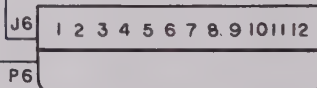
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PART OF
A6

MOTHER BOARD
ASSY A03265000
SCHEM D03266700

PART OF
FRONT PANEL ASSY
A03276300



BLK
BRN
RED
ORN
YEL
GRN
NC
KEY
BLU
VIO
GRY
WHT
NC

DS2

PULSES

DS1

ERRORS

R4

2.5K

X-TALK GEN

TO E4

BLK

R5

2.5K

R3

5.1K

R1

1K

C.W.

R2

5.1K

LOSS CAL
(32 DB)

METER

S6

LOSS

X-TALK

E2

BATTERY TRAY ASSY
D03138700

RED

BT1

BT2

BT3

BT4

XF1

3/4 A

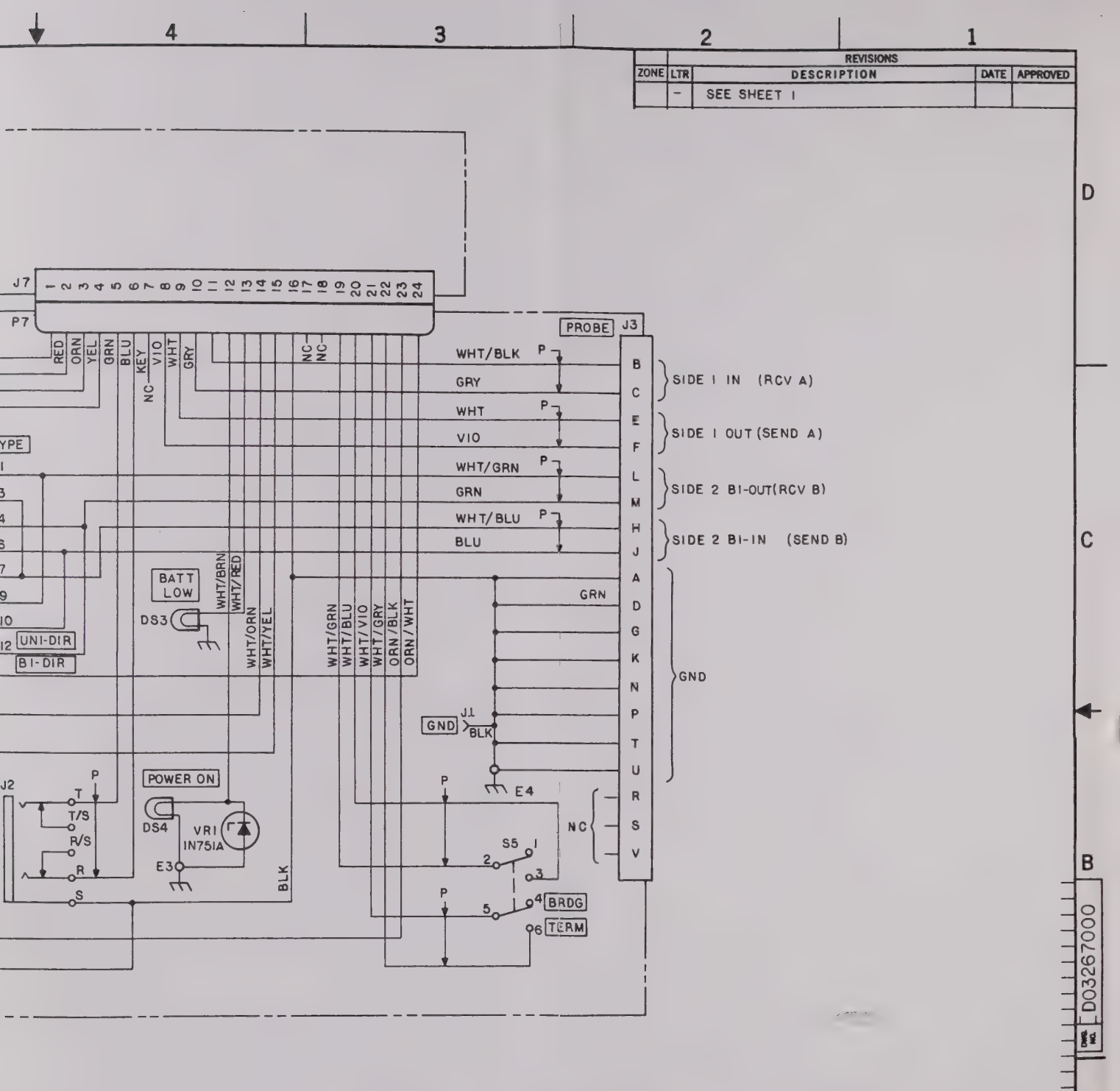
BLK

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QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED.				FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.		DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.		
TOLERANCE UNLESS SPECIFIED: BASIC TWO PLACE THREE PLACE				INTERCONNECT DIAGRAM 413A				
UP TO 6 ± .02 ±				DATE 8/23/77 BY [Signature]				
6 TO 24 ± .03 ±				SIZE D DRAWING NO. D03267000 REV. C				
ABOVE 24 ± .06 ±				CHECKED [Signature]				
ANGULAR DIMENSION ±				SCALE STOCK AS SHEET 2 OF 3				
FINISH:				APR 8/14/77				
ASSY. OR ITEM				APPLICATION				
QTY. NEXT				MODEL NO. 413A				
NEXT ASSY.				DATE 8/23/77				

D

C

B

D03267000

Dwg. No.

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PART OF
FRONT PANEL
A03276300

CHASSIS ASSY
A03278600



GRN
WHT



GRN
WHT

BRN

T1

5

2

3

4

RED

ORN

S7

1

2

3

4

5

6

230V0

P9



POWER SUPPLY PANEL
ASSY A03276700

MDA960-1

CR3

GRN

BLU

BRN

BLK

VR1

LM317K

IN

2

ADJ

1

OUT

3

CR2

IN4385

CR1

IN4385

R1

3.0

5W

YEL

1

2

Q1

PIO

MJE-2955

E

1

C

2

B

3

VR2

LM340K

IN

1

OUT

2

GND

3

D

C

B

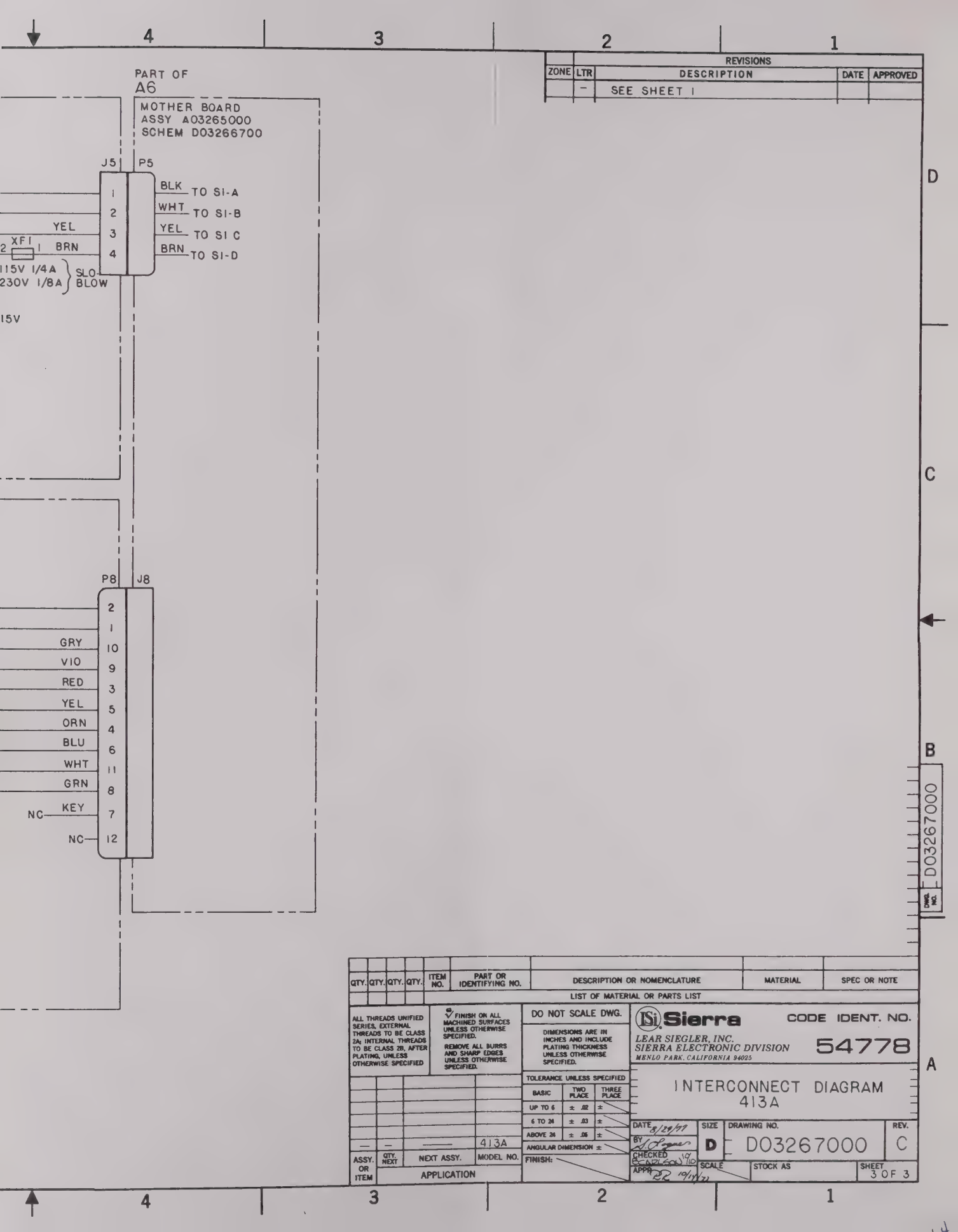
A

8

7

6

5



PART OF
PI

C

L

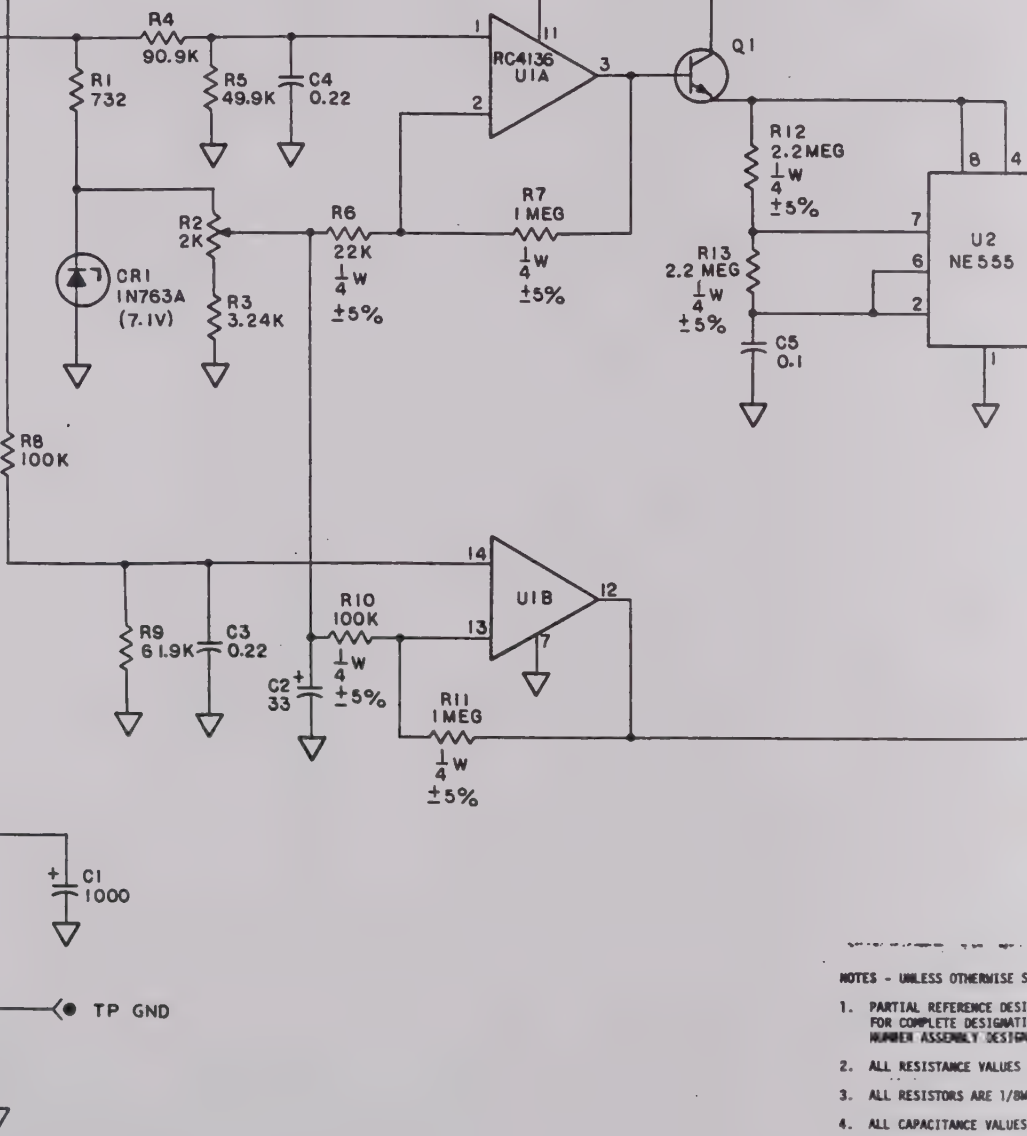
K

A

B

8

TP GND

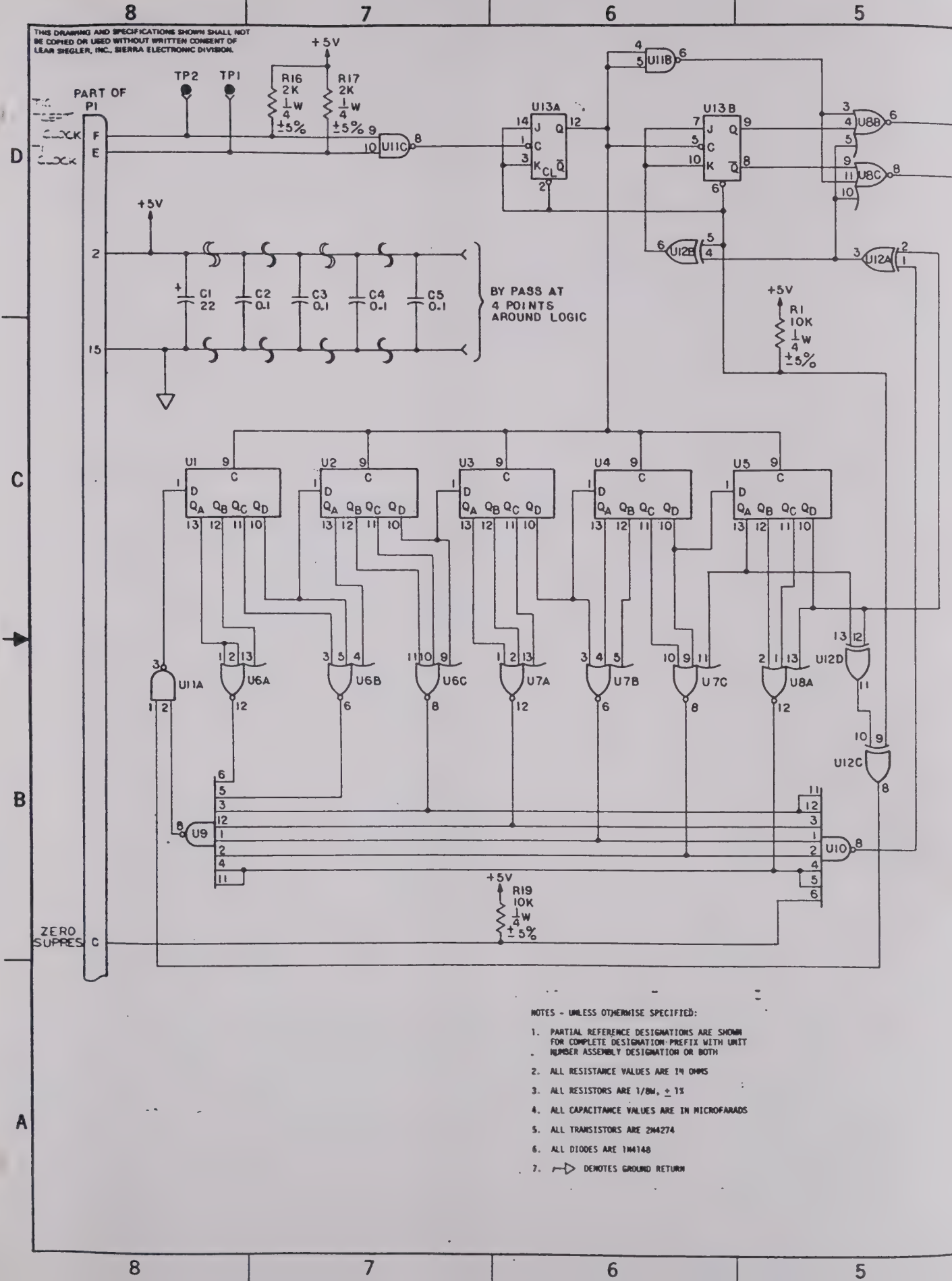


NOTES - UNLESS OTHERWISE SP

1. PARTIAL REFERENCE DESIG FOR COMPLETE DESIGNATION NUMBER ASSEMBLY DESIGNATION
2. ALL RESISTANCE VALUES A
3. ALL RESISTORS ARE 1/8W.
4. ALL CAPACITANCE VALUES
5. ALL DIODES ARE 1N4148
7. ALL TRANSISTORS ARE 2N3
8. ∇ DENOTES GROUND R

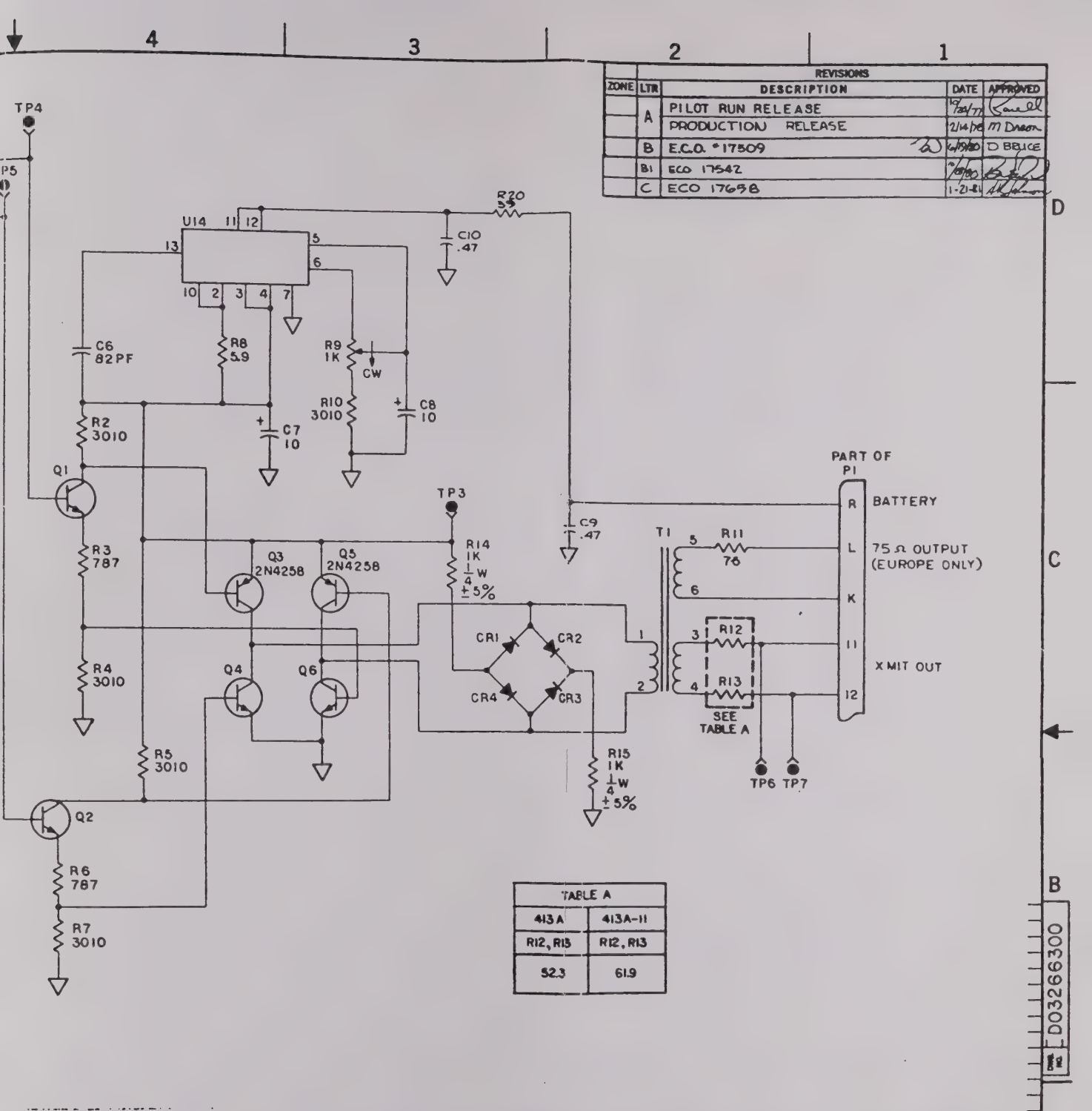
REF DESIG	DESCRIPTION	SIERRA PART NUMBER
A 1	PWB ASSY A1 413A	C03263200
C 1	CAP. ELECTROLYTIC 1000 UF 35VDC	902280108
C 2	CAP. TANT 33 UF 10% 10VDC	902700336
C 3	CAP. CERAMIC 0.22 UF 10% 50V CK06	901330224
C 4	CAP. CERAMIC 0.22 UF 10% 50V CK06	901330224
C 5	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 6	CAP. DIPPED MICA 1000PF 5% 500V DM19	901910102
C 7	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
CR 1	DIODE IN763A ZENER 7.1V	910500030
CR 2	DIODE IN4148	910504148
CR 3	DIODE IN4148	910504148
CR 4	DIODE ZENER IN752A 5.6V	910630752
Q 1	TRANSISTOR 2N3904 NPN	910303904
Q 2	TRANSISTOR 2N3904 NPN	910303904
Q 3	TRANSISTOR 2N3904 NPN	910303904
R 1	RES. MET FILM 732 OHM 1/8W 1%	907307320
R 2	RES. 2K 10% 15 TURN POT	907900288
R 3	RES. MET FILM 3.24K OHM 1/8W 1%	907303241
R 4	RES. MET. FILM 90.9K OHM 1/8W 1%	907309092
R 5	RES. MET. FILM 49.9K OHM 1% 1/8W	907304992
R 6	RES. FXD COMP 22K OHM 1/4W 5%	906900223
R 7	RES. COMP 1 MEGOHM 1/4W 5%	906900105
R 8	RES. MET FILM 100K OHM 1% 1/8W	907301003
R 9	RES. MET FILM 61.9K OHM 1% 1/8W	907306192
R 10	RES. FXD COMP 100K OHM 1/4W 5%	906900104
R 11	RES. COMP 1 MEGOHM 1/4W 5%	906900105
R 12	RES. COMP 2.2 MEGOHM 5% 1/4W	906900225
R 13	RES. COMP 2.2 MEGOHM 5% 1/4W	906900225
R 14	RES. COMP 10K OHM 1/4W 5%	906900103
R 15	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 16	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 17	RES. FXD COMP 2.2K OHM 1/4W 5%	906900222
R 18	RES. COMP 910 OHM 1/4W 5%	906900911
R 19	RES. FXD COMP 510 OHM 1/4W 5%	906900511
R 20	RES. 1 OHM 1W 1%	907601R00
R 21	RES. FILM METAL 1.10K OHM 1/8W 1%	907301101
R 22	RES. 500 OHM 10% 15 TURN. POT	907900315
R 23	RES. MET FILM 3.24K OHM 1/8W 1%	907303241
R 24	RES. COMP 270 OHM 5% 1/4W	906900271
U 1	IC RC4136 QUAD OPERATIONAL AMP	920304136
U 2	IC NE555	920300555
U 3	IC LM723D VOLTAGE REGULATOR	920310723

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BE COPIED OR USED WITHOUT WRITTEN CONSENT OF
LEAR SIEGLER, INC., SIERRA ELECTRONIC DIVISION.



NOTES - UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION-PREFIX WITH UNIT NUMBER ASSEMBLY DESIGNATION OR BOTH
2. ALL RESISTANCE VALUES ARE IN OHMS
3. ALL RESISTORS ARE 1/8W, ±1%
4. ALL CAPACITANCE VALUES ARE IN MICROFARADS
5. ALL TRANSISTORS ARE 2N4274
6. ALL DIODES ARE 1N4148
7. ∇ DENOTES GROUND RETURN



REVISIONS			
ZONE	LTR	DESCRIPTION	DATE APPROVED
	A	PILOT RUN RELEASE	10/24/77 <i>Canell</i>
		PRODUCTION RELEASE	2/14/80 <i>M. Dream</i>
	B	E.C.O. #17509	2/14/80 <i>D. BEUCE</i>
	B1	ECO 17542	7/1/80 <i>B. B. B.</i>
	C	ECO 17638	1-21-81 <i>B. B. B.</i>

TABLE A	
413A	413A-11
R12, R13	R12, R13
523	619

DEVICE PIN OUT				
REF DESIG	DEVICE NO	+5V	GRD	
U1-U5	74LS95A	14	6,7	
U6-U8	74LS27	14	7	
U9-U10	74LS30	14	7	
U11	74LS00	14	7	
U12	74LS86	14	7	
U13	74LS73	4	11	
U14	LM230	-	7	

QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								
ALL THREADS UNFINISHED SERIES, EXTERNAL THREADS TO BE CLASS 3A, INTERNAL THREADS TO BE CLASS 3B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED.				FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.		DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.		
TOLERANCE UNLESS SPECIFIED: BASIC TWO PLACE THREE PLACE UP TO 6 ± .02 ± .01 6 TO 30 ± .03 ± .02 ABOVE 30 ± .04 ± .03 ANGULAR DIMENSION ± .5°				SCHEMATIC DIAGRAM - A2 PSEUDO RANDOM WORD GEN				
ASSY. OR ITEM				QTY. NEXT		NEXT ASSY.		MODEL NO. 413A-11 413A
APPLICATION				DATE 8/31/77 BY <i>[Signature]</i> CHECKED <i>[Signature]</i> APPR <i>[Signature]</i>		SIZE D D03266300		REV. C
STOCK AS				SHEET 1 OF 1		CODE IDENT. NO. 54778 LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION MENLO PARK, CALIFORNIA 94025		

D03266300

A 2	PWB ASSY. A2 41JA	003263500
C 1	CAP. TANT 22 UF 10% 15V	902740226
C 2	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 3	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 4	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 5	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 6	CAP. DIPPED MICA 82PF 2% 500V	901900820
C 7	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 8	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 9	CAP. 0.47 UF 100V	901320474
C 10	CAP. 0.47 UF 100V	901320474
CR 1	DIODE IN4148	910504148
CR 2	DIODE IN4148	910504148
CR 3	DIODE IN4148	910504148
CR 4	DIODE IN4148	910504148
Q 1	TRANSISTOR 2N4274 NPN	910304274
Q 2	TRANSISTOR 2N4274 NPN	910304274
Q 3	TRANSISTOR 2N4258 NPN	910304258
Q 4	TRANSISTOR 2N4274 NPN	910304274
Q 5	TRANSISTOR 2N4258 NPN	910304258
Q 6	TRANSISTOR 2N4274 NPN	910304274
R 1	RES. COMP 10K OHM 1/4W 5%	906900103
R 2	RES. FXD FILM 3.01K OHM 1/8W 1%	907303011
R 3	RES. MET FILM 787 OHM 1% 1/8W	907307870
R 4	RES. FXD FILM 3.01K OHM 1/8W 1%	907303011
R 5	RES. FXD FILM 3.01K OHM 1/8W 1%	907303011
R 6	RES. MET FILM 787 OHM 1% 1/8W	907307870
R 7	RES. FXD FILM 3.01K OHM 1/8W 1%	907303011
R 8	RES. FXD FILM 5.9 OHM 1/8W 1%	907305R90
R 9	RES. 1K 15 TURN POT 10%	907900290
R 10	RES. FXD FILM 3.01K OHM 1/8W 1%	907303011
R 11	RES. MET FILM 75 OHM 1% 1/8W	907300750
R 12	RES. MET FILM 52.3 OHM 1/8W 1%	907352R30
R 13	RES. MET FILM 52.3 OHM 1/8W 1%	907352R30
R 14	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 15	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 16	RES. COMP 2K OHM 1/4W 5%	906900202
R 17	RES. COMP 2K OHM 1/4W 5%	906900202
R 19	RES. COMP 10K OHM 1/4W 5%	906900103
R 20	RES. COMP 39 OHM 5% 1/4W	906900390
T 1	TRANSFORMER PULSE	909900041
U 1	IC SN74LS95AN	920307495
U 2	IC SN74LS95AN	920307495
U 3	IC SN74LS95AN	920307495
U 4	IC SN74LS95AN	920307495
U 5	IC SN74LS95AN	920307495
U 6	IC SN74LS27N	920317427
U 7	IC SN74LS27N	920317427
U 8	IC SN74LS27N	920317427

PWB ASSY A2 413A (continued)

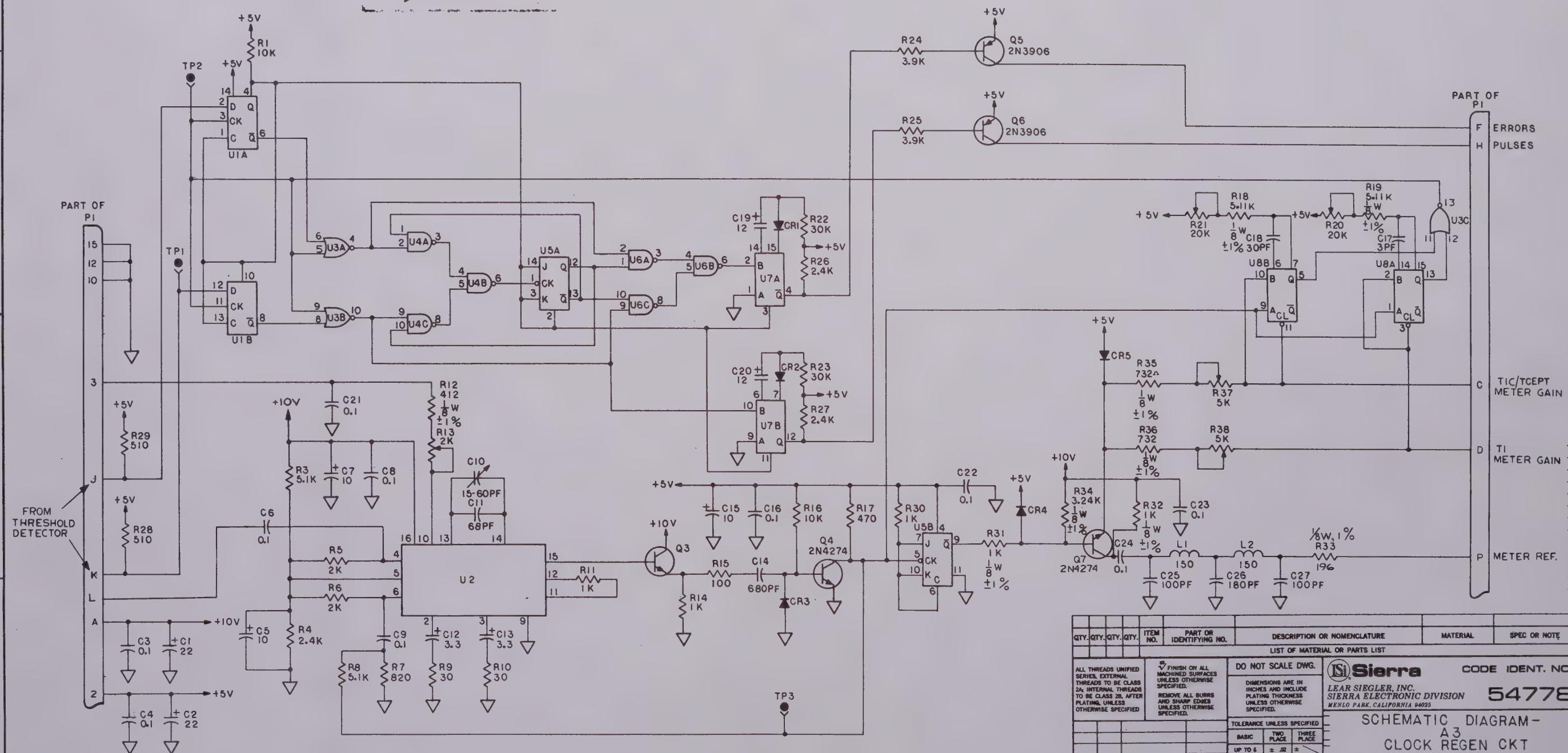
U 9	IC SN74LS30N	920317430
U 10	IC SN74LS30N	920317430
U 11	IC SN74LS00N	920327400
U 12	IC SN74LS86N	920317486
U 13	IC SN74LS73N	920317473
U 14	IC LM723D VOLTAGE REGULATOR	920310723

NOTES - UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER ASSEMBLY DESIGNATION OR BOTH
2. ALL RESISTANCE VALUES ARE IN OHMS
3. ALL RESISTORS ARE $1/4W, \pm 5\%$
4. ALL CAPACITANCE VALUES ARE IN MICROFARADS
5. ALL INDUCTANCE VALUES ARE IN MICROHENRYS
6. ALL DIODES ARE 1N4148
7. ALL TRANSISTORS ARE 2N3904
8.  DENOTES GROUND RETURN

DEVICE PIN OUT				
REF DESIG	DEVICE NO	+5V	+10V	GND
U1	74LS74	14	-	7
U2	XR215	-	16	8
U3	74LS02	14	-	7
U4,6	74LS00	14	-	7
U5	74LS73	14	-	7
U7,8	74LS123	16	-	8

		REVISIONS	
ZONE	LTR	DESCRIPTION	DATE APPROVED
	A	PILOT RUN RELEASE	7/24/77 [Signature]
	A ₁	PCO 2504	1/25/78 [Signature]
	B	PRODUCTION RELEASE	2/14/78 M. D. Moore
	C	E.C.O. 17509	6/19/78 D. BRUCE
	DI	ECO 17542	7/1/80 [Signature]
	C	ECO 17625	11/19/80 [Signature]



QTY. QTY. QTY. QTY.			ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST							
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A; INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED				DO NOT SCALE DWG. FINISH:			
✓ FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.				DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.			
TOLERANCE UNLESS SPECIFIED BASIC TWO PLACE THREE PLACE UP TO 6 ± .02 ± 6 TO 24 ± .03 ± ABOVE 24 ± .06 ± ANGULAR DIMENSION ±				(ISI) Sierra CODE IDENT. NO. LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION 54778 MENLO PARK, CALIFORNIA 94025 SCHEMATIC DIAGRAM - A3 CLOCK REGEN CKT			
ASSY. QTY. NEXT OR ITEM				DATE 4/1/70 BY [Signature] CHECKED [Signature] APPR [Signature] SCALE STOCK AS SHEET 1 OF			
NEXT ASSY. MODEL NO. APPLICATION				D03266400			

A 3	PWB ASSY. A3 413A	003263900
C 1	CAP. TANT 22 UF 10% 15V	902740226
C 2	CAP. TANT 22 UF 10% 15V	902740226
C 3	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 4	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 5	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 6	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 7	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 8	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 9	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 10	CAP. VARIABLE CERAMIC 15-60PF	903220600
C 11	CAP. DIPPED MICA 68PF DM15	901900680
C 12	CAP. TANT 3.3 UF 15 VDC	902700335
C 13	CAP. TANT 3.3 UF 15 VDC	902700335
C 14	CAP. DIPPED MICA 680PF 5% 300V DM15	901900681
C 15	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 16	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 17	CAP. MICA 3PF DM15	901900030
C 18	CAP. DIPPED MICA 30PF DM15	901900300
C 19	CAP. TANT 12 UF 20 VDC	902700126
C 20	CAP. TANT 12 UF 20 VDC	902700126
C 21	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 22	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 23	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 24	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 25	CAP. DIPPED MICA 100PF 5% 500V	901900101
C 26	CAP. DIPPED MICA 180PF 5% 500V	901900181
C 27	CAP. DIPPED MICA 100PF 5% 500V	901900101
CR 1	DIODE IN4148	910504148
CR 2	DIODE IN4148	910504148
CR 3	DIODE IN4148	910504148
CR 4	DIODE IN4148	910504148
CR 5	DIODE IN4148	910504148
L 1	INDUCTOR FXD 150 UF	909000185
L 2	INDUCTOR FXD 150 UF	909000185
Q 3	TRANSISTOR 2N3904 NPN	910303904
Q 4	TRANSISTOR 2N4274 NPN	910304274
Q 5	TRANSISTOR 2N3906 PNP	910303906
Q 6	TRANSISTOR 2N3906 PNP	910303906
Q 7	TRANSISTOR 2N4274 NPN	910304274
R 1	RES. COMP 10K OHM 1/4W 5%	906900103
R 3	RES. 5.1K 1/4W 5%	906900512
R 4	RES. COMP 2.4K OHM 5% 1/4W	906900242
R 5	RES. COMP 2K OHM 1/4W 5%	906900202
R 6	RES. COMP 2K OHM 1/4W 5%	906900202
R 7	RES. COMP 820 OHM 1/4W 5%	906900821
R 8	RES. 5.1K 1/4W 5%	906900512
R 9	RES. COMP 30 OHM 1/4W 5%	906900300
R 10	RES. COMP 30 OHM 1/4W 5%	906900300

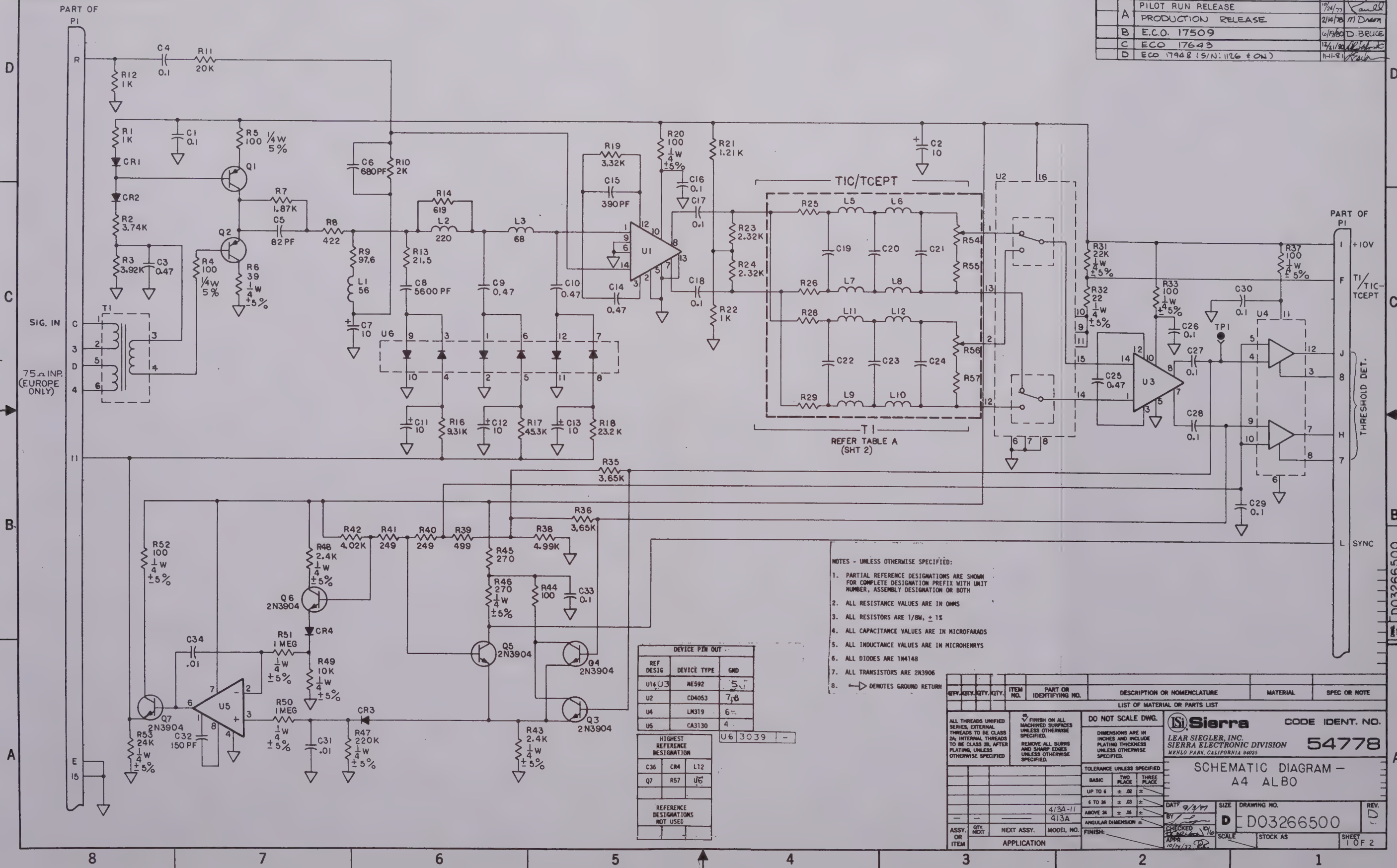
PWB ASSY A3 413A (continued)

R 11	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 12	RES. MET FILM 412 OHM 1% 1/8W	907304120
R 13	RES. 2K 10% 15 TURN POT	907900288
R 14	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 15	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 16	RES. COMP 10K OHM 1/4W 5%	906900103
R 17	RES. COMP 470 OHM 5% 1/4W	906900471
R 18	RES. MET FILM 5.11K OHM 1% 1/8W	907305111
R 19	RES. MET FILM 5.11K OHM 1% 1/8W	907305111
R 20	RES. 20K 10% POT	907900331
R 21	RES. 20K 10% POT	907900331
R 22	RES. COMP 30K OHM 1/4W 5%	906900303
R 23	RES. COMP 30K OHM 1/4W 5%	906900303
R 24	RES. COMP 3.9K OHM 1/4W 5%	906900392
R 25	RES. COMP 3.9K OHM 1/4W 5%	906900392
R 26	RES. COMP 2.4K OHM 5% 1/4W	906900242
R 27	RES. COMP 2.4K OHM 5% 1/4W	906900242
R 28	RES. FXD COMP 510 OHM 1/4W 5%	906900511
R 29	RES. FXD COMP 510 OHM 1/4W 5%	906900511
R 30	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 31	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 32	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 33	RES. MET FILM 196 OHM 1/8W 1%	907301960
R 34	RES. MET FILM 3.24K OHM 1/8W 1%	907303241
R 35	RES. MET FILM 732 OHM 1/8W 1%	907307320
R 36	RES. MET FILM 732 OHM 1/8W 1%	907307320
R 37	RES. 5K 10% 15 TURN POT	907900316
R 38	RES. 5K 10% 15 TURN POT	907900316
U 1	IC SN74LS74	920317474
U 2	IC XR215	920300215
U 3	IC SN74LS02	920337402
U 4	IC SN74LS00N	920327400
U 5	IC SN74LS73N	920317473
U 6	IC SN74LS00N	920327400
U 7	IC SN74LS123N	920314123
U 8	IC SN74LS123N	920314123
X 1	EJECTOR CARD	920400022

920327402

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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	PILOT RUN RELEASE	7/24/77	Canell
		PRODUCTION RELEASE	2/14/78	M. D. Brown
	B	E.C.O. 17509	6/19/80	D. BRUCE
	C	ECO 17643	12/11/80	ALB
	D	ECO 17948 (S/N: 1126 & ON)	11-1-81	ALB



A 4	PWB ASSY A4 413A	D03264300
C 1	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 2	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 3	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 4	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 5	CAP. DIPPED MICA 82PF 2% 500V	901900820
C 6	CAP. DIPPED MICA 680PF 5% 300V DM15	901900681
C 7	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 8	CAP. DIPPED MICA 5600PF 2% 300V	901910562
C 9	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 10	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 11	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 12	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 13	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 14	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 15	CAP. DIPPED MICA 390PF 2% 500V	901910391
C 16	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 17	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 18	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 19	CAP. MICA 8PF	901900080
C 20	CAP. DIPPED MICA 33PF 2% 500V	901900330
C 21	CAP. DIPPED MICA 91PF 2% 500V	901900910
C 22	CAP. DIPPED MICA 33PF 2% 500V	901900330
C 23	CAP. DIPPED MICA 150 PF	901900151
C 24	CAP. DIPPED MICA 270PF	901900271
C 25	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 26	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 27	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 28	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 29	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 30	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 31	CAP. CERAMIC 0.01 UF 10% 100V CK05	901320103
C 32	CAP. DIPPED MICA 150 PF	901900151
C 33	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 34	CAP. CERAMIC 0.01 UF 10% 100V CK05	901320103
C 35	CAP. DIPPED MICA 47 PF 5% 500V	901900470
CR 1	DIODE IN4148	910504148
CR 2	DIODE IN4148	910504148
CR 3	DIODE IN4148	910504148
CR 4	DIODE IN4148	910504148
L 1	INDUCTOR SHIELDED RF 56UH 5%	909000741
L 2	INDUCTOR SHIELDED RF 220UH 5%	909000186
L 3	INDUCTOR SHIELDED RF 68UH 5% .22W	909000136
L 5	INDUCTOR SHIELDED RF 47UH 10%	909000191
L 6	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 7	INDUCTOR SHIELDED RF 47UH 10%	909000191
L 8	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 9	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 10	INDUCTOR SHIELDED RF 220UH 10%	909000193

PWB ASSY A4 413A (continued)

L 11	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 12	INDUCTOR SHIELDED RF 220UH 10%	909000193
Q 1	TRANSISTOR 2N3906 PNP	910303906
Q 2	TRANSISTOR 2N3906 PNP	910303906
Q 3	TRANSISTOR 2N3904 NPN	910303904
Q 4	TRANSISTOR 2N3904 NPN	910303904
Q 5	TRANSISTOR 2N3904 NPN	910303904
Q 6	TRANSISTOR 2N3904 NPN	910303904
Q 7	TRANSISTOR 2N3904 NPN	910303904
R 1	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 2	RES. MET FILM 3.74K OHM 1% 1/8W	907303741
R 3	RES. 3.92K OHM 1% 1/8W	907303921
R 4	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 5	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 6	RES. COMP 39 OHM 5% 1/4W	906900390
R 7	RES. MET FILM 1.87K OHM 1/8W 1%	907301871
R 8	RES. 442 OHM 1% 1/8W	907304420
R 9	RES. MET FILM 97.6 OHM 1% 1/8W	907397R60
R 10	RES. 2.0K 1% 1/8W FILM	907302001
R 11	RES. COMP 20.0K OHM 1% 1/8W	907302002
R 12	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 13	RES. MET FILM 21.5 OHM 1% 1/8W	907321R50
R 14	RES. MET FILM 619 OHM 1% 1/8W	907306190
R 16	RES. 9.31K OHM 1/8W 1%	907309311
R 17	RES. 45.3K OHM 1% 1/8W	907304532
R 18	RES. 23.2K OHM 1/8W 1%	907302322
R 19	RES. FILM 3.32K OHM 1% 1/8W	907303321
R 20	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 21	RES. METAL FILM 1.21K OHM 1/8W 1%	907301211
R 22	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 23	RES. MET FILM 2.32K OHM 1/8W 1%	907302321
R 24	RES. MET FILM 2.32K OHM 1/8W 1%	907302321
R 25	RES. MET FILM 1.05K OHM 1% 1/8W	907301051
R 26	RES. MET FILM 1.05K OHM 1% 1/8W	907301051
R 28	RES. MET FILM 732 OHM 1/8W 1%	907307320
R 29	RES. MET FILM 732 OHM 1/8W 1%	907307320
R 31	RES. FXD COMP 22K OHM 1/4W 5%	906900223
R 32	RES. FXD COMP 22K OHM 1/4W 5%	906900223
R 33	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 35	RES. MET FILM 3.65K OHM 1/8W 1%	907303651
R 36	RES. MET FILM 3.65K OHM 1/8W 1%	907303651
R 37	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 38	RES. MET FILM 4.99K OHM 1/8W 1%	907304991
R 39	RES. MET FILM 499 OHM 1% 1/8W	907304990
R 40	RES. 249 OHM 1% 1/8W	907302490
R 41	RES. 249 OHM 1% 1/8W	907302490
R 42	RES. FXD FILM 4.02K OHM 1/8W 1%	907304021
R 43	RES. COMP 2.4K OHM 5% 1/4W	906900242
R 44	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 45	RES. COMP 270 OHM 5% 1/4W	906900271

PWB ASSY A4 413A (continued)

R 46	RES. COMP 270 OHM 5% 1/4W	906900271
R 47	RES. FXD COMP 220K OHM 1/4W 5%	906900224
R 48	RES. COMP 2.4K OHM 5% 1/4W	906900242
R 49	RES. COMP 10K OHM 1/4W 5%	906900103
R 50	RES. COMP 1 MEGOHM 1/4W 5%	906900105
R 51	RES. COMP 1 MEGOHM 1/4W 5%	906900105
R 52	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 53	RES. COMP. 24K OHM 5% 1/4W	906900243
R 54	RES. 1K 15 TURN POT 10%	907900290
R 55	RES. FILM METAL 1.10K OHM 1/8W 1%	907301101
R 56	RES. 1K 15 TURN POT 10%	907900290
R 57	RES. MET FILM 464 OHM 1/8W 1%	907304640
T 1	TRANSFORMER PULSE	909900041
U 1	IC NE592A WIDE BAND VIDEO AMP	920300592
U 2	IC CD4053B	920204053
U 3	IC NE592A WIDE BAND VIDEO AMP	920300592
U 4	IC LM319 DUAL COMPARATOR HIGH SPEED	920300319
U 5	IC CA31305 OPERATIONAL AMP	920303130
U 6	IC CA3039 DIODE ARRAY	920303039
X 1	EJECTOR CARD	920400022

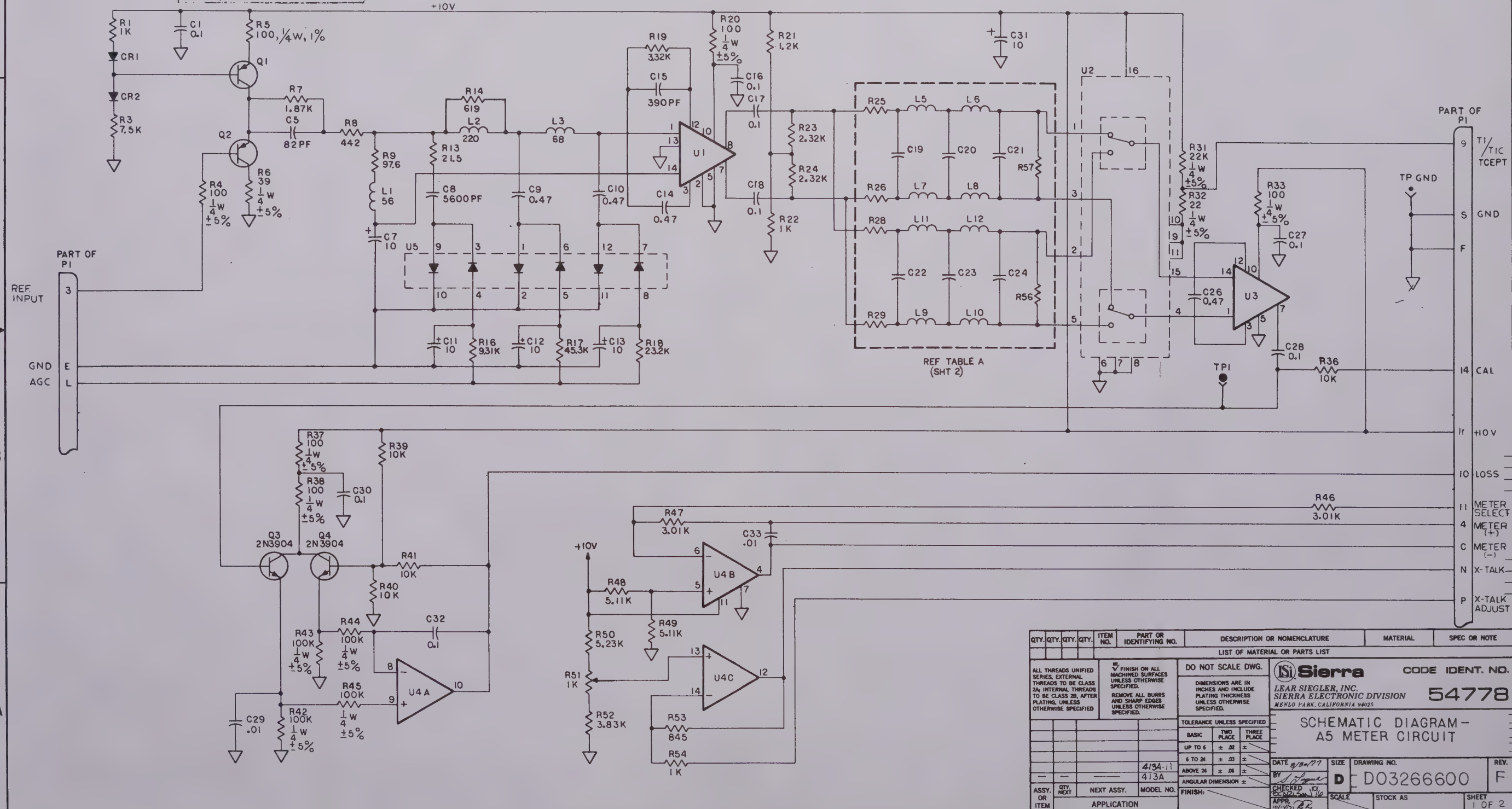
THIS DRAWING AND SPECIFICATIONS SHOWN SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAR SIEGLER, INC., SIERRA ELECTRONIC DIVISION.

- NOTES - UNLESS OTHERWISE SPECIFIED:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER, ASSEMBLY DESIGNATION OR BOTH
 2. ALL RESISTANCE VALUES ARE IN OHMS
 3. ALL RESISTORS ARE 1/8W, $\pm 1\%$
 4. ALL CAPACITANCE VALUES ARE IN MICROFARADS
 5. ALL INDUCTANCE VALUES ARE IN MICROHENRYS
 6. ALL DIODES ARE 1N4148
 7. ALL TRANSISTORS ARE 2N3906
 8. ∇ DENOTES GROUND RETURN

DEVICE PIN OUT		
REF DESIG	DEVICE TYPE	GND
U1	NE592	5
U2	CD4053	7,8
U4	RC4136	7
U5	LA3039	9

HIGHEST REFERENCE DESIGNATION		
C36	CR4	L12
Q7	R57	U5
REFERENCE DESIGNATIONS NOT USED		

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
A		PILOT RUN RELEASE	12/24/77
		PRODUCTION RELEASE	2/14/78
B		E.C.O. 17509	6/19/80
C		ECO 17590	10/17/80
D		ECO 17643	12-2-81
E		ECO 17648	1-21-82
F		ECO 17683	3/17/81



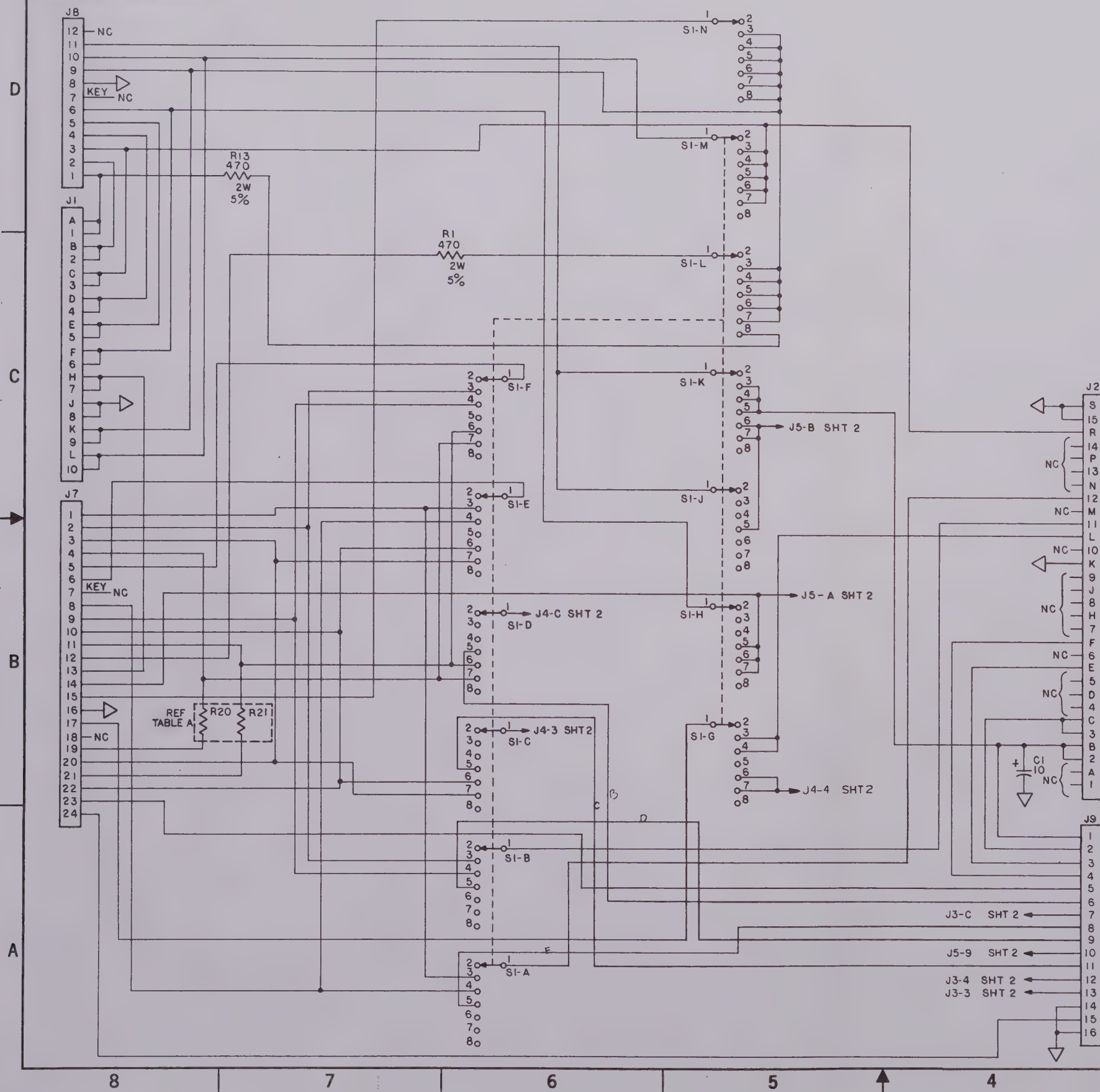
QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST							
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A; INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED.				DO NOT SCALE DWG.			
FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.				DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.			
				TOLERANCE UNLESS SPECIFIED			
				BASIC TWO THREE			
				UP TO 6 $\pm .005$ $\pm .002$			
				6 TO 24 $\pm .003$ $\pm .001$			
				ABOVE 24 $\pm .005$ $\pm .002$			
				ANGULAR DIMENSION $\pm .005$			
				FINISH:			
ASSY. OR ITEM				APPLICATION			
				DATE 8/30/77			
				BY [Signature]			
				CHECKED [Signature]			
				APPROVED [Signature]			
				SIZE DRAWING NO.			
				D D03266600			
				SCALE STOCK AS			
				SHEET 1 OF 2			

A 5	PBW ASSY. A5 413A	D03264700
C 1	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 5	CAP. DIPPED MICA 82PF 2% 500V	901900820
C 7	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 8	CAP. DIPPED MICA 5600PF 2% 300V	901910562
C 9	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 10	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 11	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 12	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 13	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 14	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 15	CAP. DIPPED MICA 390PF 2% 500V	901910391
C 16	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 17	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 18	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 19	CAP. MICA 8PF	901900080
C 20	CAP. DIPPED MICA 33PF 2% 500V	901900330
C 21	CAP. DIPPED MICA 91PF 2% 500V	901900910
C 22	CAP. DIPPED MICA 33PF 2% 500V	901900330
C 23	CAP. DIPPED MICA 150PF	901900750
C 24	CAP. DIPPED MICA 270PF	901900271
C 26	CAP. CERAMIC 0.47 UF 20% 50V	901300474
C 27	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 28	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 29	CAP. CERAMIC 0.01 UF 10% 100V CK05	901320103
C 30	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 31	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 32	CAP. CERAMIC 0.1 UF 20% 50V CK06	901300104
C 33	CAP. CERAMIC 0.01 UF 10% 100V CK05	901320103
CR 1	DIODE IN4148	910504148
CR 2	DIODE IN4148	910504148
L 1	INDUCTOR SHIELDED RF 56UH	909000226
L 2	INDUCTOR SHIELDED RF 220UH 5%	909000186
L 3	INDUCTOR SHIELDED RF 68UH 5%	909000225
L 5	INDUCTOR SHIELDED RF 47UH 10%	909000191
L 6	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 7	INDUCTOR SHIELDED RF 47UH 10%	909000191
L 8	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 9	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 10	INDUCTOR SHIELDED RF 220UH 10%	909000193
L 11	INDUCTOR SHIELDED RF 100UH 10%	909000192
L 12	INDUCTOR SHIELDED RF 220UH 10%	909000193
Q 1	TRANSISTOR 2N3906 PNP	910303906
Q 2	TRANSISTOR 2N3906 PNP	910303906
Q 3	TRANSISTOR 2N3904 NPN	910303904
Q 4	TRANSISTOR 2N3904 NPN	910303904
R 1	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 3	RES. MET FILM 7.50K OHM 1% 1/8W	907307501
R 4	RES. FXD COMP 100 OHM 1/4W 5%	906900101

PWB ASSY A5 413A (continued)

R 5	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 6	RES. COMP 39 OHM 5% 1/4W	906900390
R 7	RES. MET FILM 1.87K OHM 1/8W 1%	907301871
R 8	RES. 442 OHM 1% 1/8W	907304420
R 9	RES. MET FILM 97.6 OHM 1% 1/8W	907397R60
R 13	RES. MET FILM 21.5 OHM 1% 1/8W	907321R50
R 14	RES. MET FILM 619 OHM 1% 1/8W	907306190
R 16	RES. 9.31K OHM 1/8W 1%	907309311
R 17	RES. 45.3K OHM 1% 1/8W	907304532
R 18	RES. 23.2K OHM 1/8W 1%	907302322
R 19	RES. FILM 3.32K OHM 1% 1/8W	907303321
R 20	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 21	RES. METAL FILM 1.21K OHM 1/8W 1%	907301211
R 22	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 23	RES. MET FILM 2.32K OHM 1/8W 1%	907302321
R 24	RES. MET FILM 2.32K OHM 1/8W 1%	907302321
R 25	RES. MET FILM 1.05K OHM 1% 1/8W	907301051
R 26	RES. MET FILM 1.05K OHM 1% 1/8W	907301051
R 28	RES. MET FILM 732 OHM 1/8W 1%	907307320
R 29	RES. MET FILM 732 OHM 1/8W 1%	907307320
R 31	RES. FXD COMP 22K OHM 1/4W 5%	906900223
R 32	RES. FXD COMP 22K OHM 1/4W 5%	906900223
R 33	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 36	RES. 10.0K OHM 1/8W 1%	907301002
R 37	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 38	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 39	RES. 10.0K OHM 1/8W 1%	907301002
R 40	RES. 10.0K OHM 1/8W 1%	907301002
R 41	RES. 10.0K OHM 1/8W 1%	907301002
R 42	RES. FXD COMP 100K OHM 1/4W 5%	906900104
R 43	RES. FXD COMP 100K OHM 1/4W 5%	906900104
R 44	RES. FXD COMP 100K OHM 1/4W 5%	906900104
R 45	RES. FXD COMP 100K OHM 1/4W 5%	906900104
R 46	RES. FXD FILM 3.01K OHM 1/8W 1%	907303011
R 47	RES. FXD FILM 3.01K OHM 1/8W 1%	907303011
R 48	RES. MET FILM 5.11K OHM 1% 1/8W	907305111
R 49	RES. MET FILM 5.11K OHM 1% 1/8W	907305111
R 50	RES. MET FILM 5.23K OHM 1% 1/8W	907305231
R 51	RES. 1K 15 TURN POT 10%	907900290
R 52	RES. FILM METAL 3.93K OHM 1/8W 1%	907303831
R 53	RES. MET FILM 845 OHM 1/8W 1%	907308450
R 54	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 56	RES. 1470 OHM 1/8W 1%	907301471
R 57	RES. 2.15K OHM 1/8W 1%	907302151
U 1	IC NE592A WIDE BAND VIDEO AMP	920300592
U 2	IC CD4053B	920204053
U 3	IC NE592A WIDE BAND VIDEO AMP	920300592
U 4	IC RC4136 QUAD OPERATIONAL AMP	920304136
U 5	IC CA3039 DIODE ARRAY	920303039
X 1	EJECTOR CARD	920400022

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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A	PILOT RUN	RELEASE	10/24/77	Carroll
A1	PCO 2579			
B	PRODUCTION RELEASE		2/14/78	M. D. M. M.
C	E.C.O. 17509		2/1/1980	D. BRUCE
C1	ECO 17542		10/10/80	B. J. J.
D	ECO 17625		11/19/80	W. L. J.
E	ECO 17946		11/10/81	R. E. J.

NOTES - UNLESS OTHERWISE SPECIFIED:

- PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER, ASSEMBLY DESIGNATION OR BOTH
- ALL RESISTANCE VALUES ARE IN OHMS
- ALL RESISTORS ARE 1/8W, $\pm 1\%$
- ∇ DENOTES GROUND RETURN

TABLE A

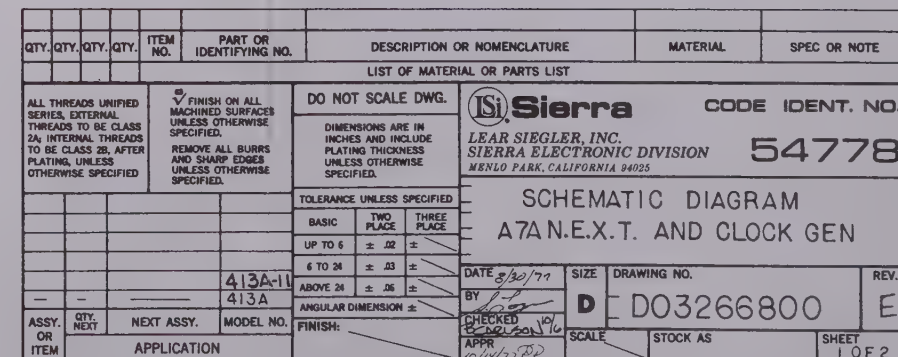
413A	413A-11
R20,21	1054R20,21 121A

QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A; INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED.					FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.		DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.	
TOLERANCE UNLESS SPECIFIED					Sierra CODE IDENT. NO. 54778			
BASIC TWO PLACE					LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION MENLO PARK, CALIFORNIA 94025			
UP TO 6 $\pm .02$					SCHEMATIC DIAGRAM - A6 MOTHER BOARD			
6 TO 24 $\pm .03$					DATE 9/14/77 SIZE DRAWING NO. D			
ABOVE 24 $\pm .05$					BY 10/10/80			
ANGULAR DIMENSION $\pm$					CHECKED BY 10/10/80			
FINISH:					APPR 10/10/80			
ASSY. OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO.	APPLICATION	SCALE	STOCK AS	SHEET 1 OF 2	REV. E

A	6	PWB ASSY. A6 413A	003265100
C	1	CAP. TANT 10 UF 10% 20V	902720106
C	2	CAP. TANT 10 UF 10% 20V	902720106
C	3	CAP. TANT 10 UF 10% 20V	902720106
C	4	CAP. TANT 10 UF 10% 20V	902720106
C	5	CAP. TANT 10 UF 10% 20V	902720106
C	6	CAP. CERAMIC DISC 2.2UF	901410225
C	7	CAP. CERAMIC DISC 2.2UF	901410225
J	1	CONNECTOR 10/20 DUAL	914800205
J	2	CONNECTOR. 15/30 DUAL	914800149
J	3	CONNECTOR. 15/30 DUAL	914800149
J	4	CONNECTOR. 15/30 DUAL	914800149
J	5	CONNECTOR. 15/30 DUAL	914800149
J	6	CONNECTOR. 12 PIN MOLEX	914800281
J	7	CONNECTOR. 24 PIN MOLEX	914800301
J	8	CONNECTOR. 12 PIN MOLEX	914800281
R	1	RES. WIREWOUND 470 OHM 2.0W 5%	906220471
R	2	RES. MET FILM 1.07K OHM 1/8W 1%	907301071
R	3	RES. MET FILM 1.07K OHM 1/8W 1%	907301071
R	4	RES. MET FILM 1.07K OHM 1/8W 1%	907301071
R	5	RES. MET FILM 1.07K OHM 1/8W 1%	907301071
R	6	RES. MET FILM 1.07K OHM 1/8W 1%	907301071
R	7	RES. MET FILM 732 OHM 1/8W 1%	907307320
R	8	RES. MET FILM 732 OHM 1/8W 1%	907307320
R	9	RES. MET FILM 732 OHM 1/8W 1%	907307320
R	10	RES. MET FILM 732 OHM 1/8W 1%	907307320
R	11	RES. MET FILM 732 OHM 1/8W 1%	907307320
R	12	RES. MET FILM 499 OHM 1% 1/8W	907304990
R	13	RES. WIREWOUND 470 OHM 2.0W 5%	906220471
R	14	RES. MET FILM 1.07K OHM 1/8W 1%	907301071
R	15	RES. 105 OHM 1% 1/8W	907301050
R	16	RES. 3.92K OHM 1% 1/8W	907303921
R	20	RES. 105 OHM 1% 1/8W	907301050
R	21	RES. 105 OHM 1% 1/8W	907301050
S	1	ASSY FUNCTION SWITCH 413A	003276600
S	2	SWITCH ROTARY 6 POS 1 POLE 1 SEC 30 DEG	911200284
W	1	RIBBON CABLE	916400062

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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A



A 7	PWB ASSY, A7 413A	003265500
C 1	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 2	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 3	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 4	CAP. DIPPED MICA 140PF 5% 500V	901900181
C 5	CAP. 39PF 500V 5% DIP DM15	901900390
C 6	CAP. DIPPED MICA 68PF DM15	901900680
C 7	CAP. DIPPED MICA 18PF DM15	901900180
C 8	CAP. .0015MF 2% 500V 100V	903100152
C 10	CAP. POLY CARB 0.01UF 2%	901910103
C 11	CAP. POLY CARB 0.01UF 2%	901910103
C 12	CAP. 2200PF 2%	901910222
C 13	CAP. 200PF 2% DIP	901910201
C 16	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 17	CAP. TANT 4.7UF 10% 10V	902710475
C 19	CAP. 0.001 UF 200V 10% CER	901320102
C 20	CAP. DIPPED MICA 33PF 2% 500V	901900330
C 21	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 22	CAP. TANT 4.7UF 10% 10V	902710475
C 23	CAP. 0.001 UF 200V 10% CER	901320102
C 24	CAP. DIPPED MICA 33PF 2% 500V	901900330
C 25	CAP. 9100 PF 2%	901900912
C 26	CAP. DIPPED TANT 10 UF 20% 20VDC	902710106
C 27	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 28	CAP. RADIAL LEADS 0.1 UF 10% 100V CK06	901330104
C 29	CAP. DIPPED MICA 680PF 5% 300V DM15	901900681
C 31	CAP. 680 PF 2%	901910681
C 32	CAP. 2200PF 2%	901910222
C 34	CAP. 2200PF 2%	901910222
CR 1	DIODE IN4148	910504148
CR 2	DIODE IN4148	910504148
CR 3	DIODE IN4148	910504148
CR 4	DIODE IN4148	910504148
CR 5	DIODE IN4148	910504148
CR 6	DIODE IN4148	910504148
J 1	SOCKET DIP 16 PIN	914200084
L 1	INDUCTOR FXD MOLDED 180UH 5% .22W	909000142
L 2	INDUCTOR SHIELDED RF 60UH 5% .22W	909000136
L 3	INDUCTOR SHIELDED RF 36UH 5% .22W	909000178
L 4	INDUCTOR FXD MOLDED 100UH 5% .22W	909000145
L 5	INDUCTOR SHIELDED RF 68UH 5% .22W	909000136
L 6	INDUCTOR FXD MOLDED 19UH 5% .22W	909000140
L 8	INDUCTOR FXD MOLDED 12UH 5%	909000204
L 9	INDUCTOR SHIELDED RF 270UH 5% 1/4W	909000206
L 10	INDUCTOR FXD MOLDED 12UH 5%	909000204
L 11	INDUCTOR SHIELDED RF 270UH 5% 1/4W	909000206
L 12	INDUCTOR FXD MOLDED 10UH 10%	909000125
L 13	INDUCTOR FXD MOLDED 100UH 5% .22W	909000145
L 14	INDUCTOR FXD MOLDED 10UH 10%	909000125

PWB ASSY, A7 413A (continued)

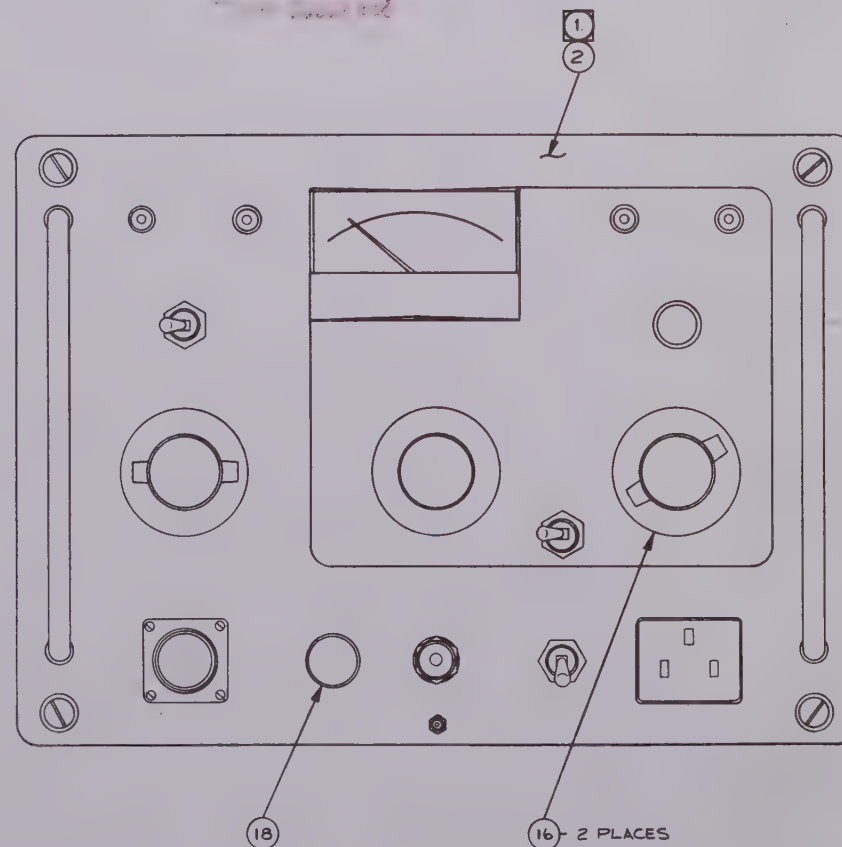
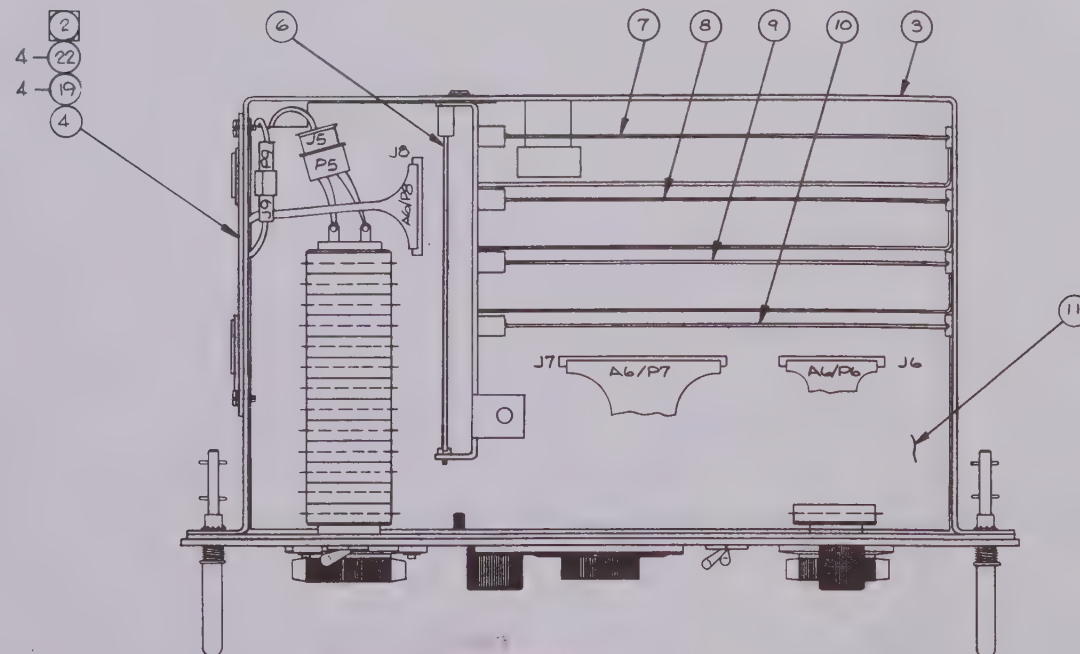
L 15	INDUCTOR FXD MOLDED 100UH 5% .22W	909000145
L 16	INDUCTOR 3.3 UH 5%	909000208
L 17	INDUCTOR 3.3 UH 5%	909000208
L 18	INDUCTOR FXD MOLDED 12UH 5%	909000204
L 19	INDUCTOR FXD MOLDED 12UH 5%	909000204
Q 1	TRANSISTOR 2N4889 PNP LO NOISE H VOLTAMP	910304889
Q 2	TRANSISTOR 2N3904 NPN	910303904
Q 3	TRANSISTOR 2N4360, P-CHANNEL K FET	910304360
Q 4	TRANSISTOR 2N3904 NPN	910303904
Q 5	TRANSISTOR 2N3904 NPN	910303904
Q 6	TRANSISTOR 2N3904 NPN	910303904
Q 7	TRANSISTOR 2N2368 NPN HI SPEED SWITCHING	910302368
Q 8	TRANSISTOR 2N3904 NPN	910303904
Q 9	TRANSISTOR 2N4265 NPN	910304265
Q 10	TRANSISTOR 2N4265 NPN	910304265
Q 11	TRANSISTOR 2N4265 NPN	910304265
Q 12	TRANSISTOR 2N4265 NPN	910304265
Q 13	TRANSISTOR 2N4265 NPN	910304265
Q 14	TRANSISTOR 2N4265 NPN	910304265
R 1	RES. 10.0K OHM 1/8W 1%	907301002
R 2	RES. 50K 10% 15 TURN POT	907900338
R 3	RES. COMP 2K OHM 1/4W 5%	906900202
R 4	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 5	RES. MET FILM 25.5 OHM 1/8W 1%	907325R50
R 6	RES. 2K 10% 15 TURN POT	907900288
R 7	RES. MET FILM 2.74K OHM 1/8W 1%	907302741
R 8	RES. MET FILM 4.99K OHM 1/8W 1%	907304991
R 9	RES. MET FILM 549 OHM 1/8W 1%	907305490
R 10	RES. MET FILM 137 OHM 1/8W 1%	907301370
R 11	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 12	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 13	RES. FXD FILM 1.0K OHM 1/8W 1%	907301001
R 14	RES. 5K 10% 15 TURN POT	907900316
R 15	RES. COMP 2K OHM 1/4W 5%	906900202
R 16	RES. COMP 2K OHM 1/4W 5%	906900202
R 17	RES. FXD COMP 1K OHM 1/4W 5%	906900102
R 18	RES. MET FILM 3.48K OHM 1% 1/8W	907303481
R 19	RES. MET FILM 681 OHM 1/8W 1%	907306810
R 20	RES. MET FILM 681 OHM 1/8W 1%	907306810
R 21	RES. FXD COMP 2.2K OHM 1/4W 5%	906900222
R 22	RES. MET FILM 210 OHM 1/8W 1%	907302100
R 23	RES. MET FILM 681 OHM 1/8W 1%	907306810
R 24	RES. MET FILM 210 OHM 1/8W 1%	907302100
R 25	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 26	RES. COMP 2K OHM 1/4W 5%	906900202
R 27	RES. MET FILM 3.48K OHM 1% 1/8W	907303481
R 28	RES. MET FILM 681 OHM 1/8W 1%	907306810
R 30	RES. MET FILM 681 OHM 1/8W 1%	907306810
R 31	RES. MET FILM 681 OHM 1/8W 1%	907306810
R 32	RES. FXD COMP 2.2K OHM 1/4W 5%	906900222

PWB ASSY, A7 413A (continued)

R 33	RES. MET FILM 210 OHM 1/8W 1%	907302100
R 34	RES. MET FILM 210 OHM 1/8W 1%	907302100
R 35	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 36	RES. COMP 2K OHM 1/4W 5%	906900202
R 41	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 42	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 43	RES. MET FILM 80.6 OHM 1/8W 1%	907380R60
R 44	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 45	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 46	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 47	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 48	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 49	RES. MET FILM 76.8 OHM 1/8W 1%	907376R80
R 50	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 51	RES. MET FILM 76.8 OHM 1/8W 1%	907376R80
R 52	RES. MET FILM 76.8 OHM 1/8W 1%	907376R80
R 53	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 54	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 55	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 56	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 57	RES. MET FILM 76.8 OHM 1/8W 1%	907376R80
R 58	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 59	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 60	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 61	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 62	RES. MET FILM 76.8 OHM 1/8W 1%	907376R80
R 63	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 64	RES. 50 OHM 10% 15 TURN PCT	907900323
R 65	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 66	RES. 50 OHM 10% 15 TURN PCT	907900323
R 70	RES. MET FILM 301 OHM 1% 1/8W	907303010
R 71	RES. FXD COMP 100 OHM 1/4W 5%	906900101
R 72	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 73	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 74	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 75	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 76	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 77	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 78	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
R 79	RES. MET FILM 49.9 OHM 1/8W 1%	907349R90
RT 1	THERMISTER 250 OHM	913600015
XY 1	CLIP CRYSTAL HOLDING STEEL	921100004
XY 2	CLIP CRYSTAL HOLDING STEEL	921100004
Y 1	CRYSTAL QUARTZ 6.304MHZ (A03206100)	912200202
Y 2	CRYSTAL QUARTZ 3.058MHZ (A03204700)	912200199
Z 1	ROTARY SWITCH 10PT 2T (C03273600)	911200263
Z 2	RIVET 0.125 DIA X 1/8 LG.	822508114

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ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	PILOT RUN RELEASE	9/28/77	Paul
	A ₂	PCO 2394, 2462	1/25/78	Paul
	B	PRODUCTION RELEASE	2/14/78	M. Dren
	C	ECO 17291	DB 11/29/79	Paul
	D	ECO 17890 (SIN: 1126 & ON)	9/30/81	C. Little



NOTES

- 1 CONNECT A6/P6 TO J6 AND CONNECT A6/P7 TO J7 BEFORE ATTACHING FRONT PANEL TO CHASSIS.
- 2 CONNECT P5 TO J5, A6/P8 TO J8, AND P9 TO J9 BEFORE ATTACHING THE POWER PANEL TO CHASSIS.
- 3 ATTACH ITEM 13 TO FRONT PANEL BEFORE ATTACHING FRONT PANEL TO CHASSIS.

FOR LIST OF MAT'L, SEE A03276100

QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED.				FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.		DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.		Sierra CODE IDENT. NO. 54778
						TOLERANCE UNLESS SPECIFIED		FINAL ASSY
						BASIC TWO THREE PLACE		
						UP TO 6 ± .02 ±		
						6 TO 24 ± .03 ±		
						ABOVE 24 ± .05 ±		
						ANGULAR DIMENSION ±		
						FINISH:		
ASSY. OR ITEM	QTY. NEXT	NEXT ASSY.	MODEL NO.	APPLICATION		DATE 7/12/77	SIZE	DRAWING NO. D03276200
						CHECKED BY D. Wills	SCALE 1/1	REV. C
						APPR. 12/21/81	STOCK AS	SHEET 1 OF 2

F A	ASSY. FINAL 413A	D03276200
FA13	LOWER SUPPORT BRACKET	C03274100
FA14	CLIP RETAINING	913500026
FA16	KNOB SKIRTED BAR	916000142
FA18	KNOB BAR	916000143
FA19	SCREW. 6-32 X 5/16	800004161
FA22	WASHER #6 SPLIT LOCK	819204021
FA24	KEP NUT 4 - 40 X 1/4	809402007
FA25	CARD GUIDE 4.5 LG	917300393
FA26	FLEXIBLE GROMMET	920100003

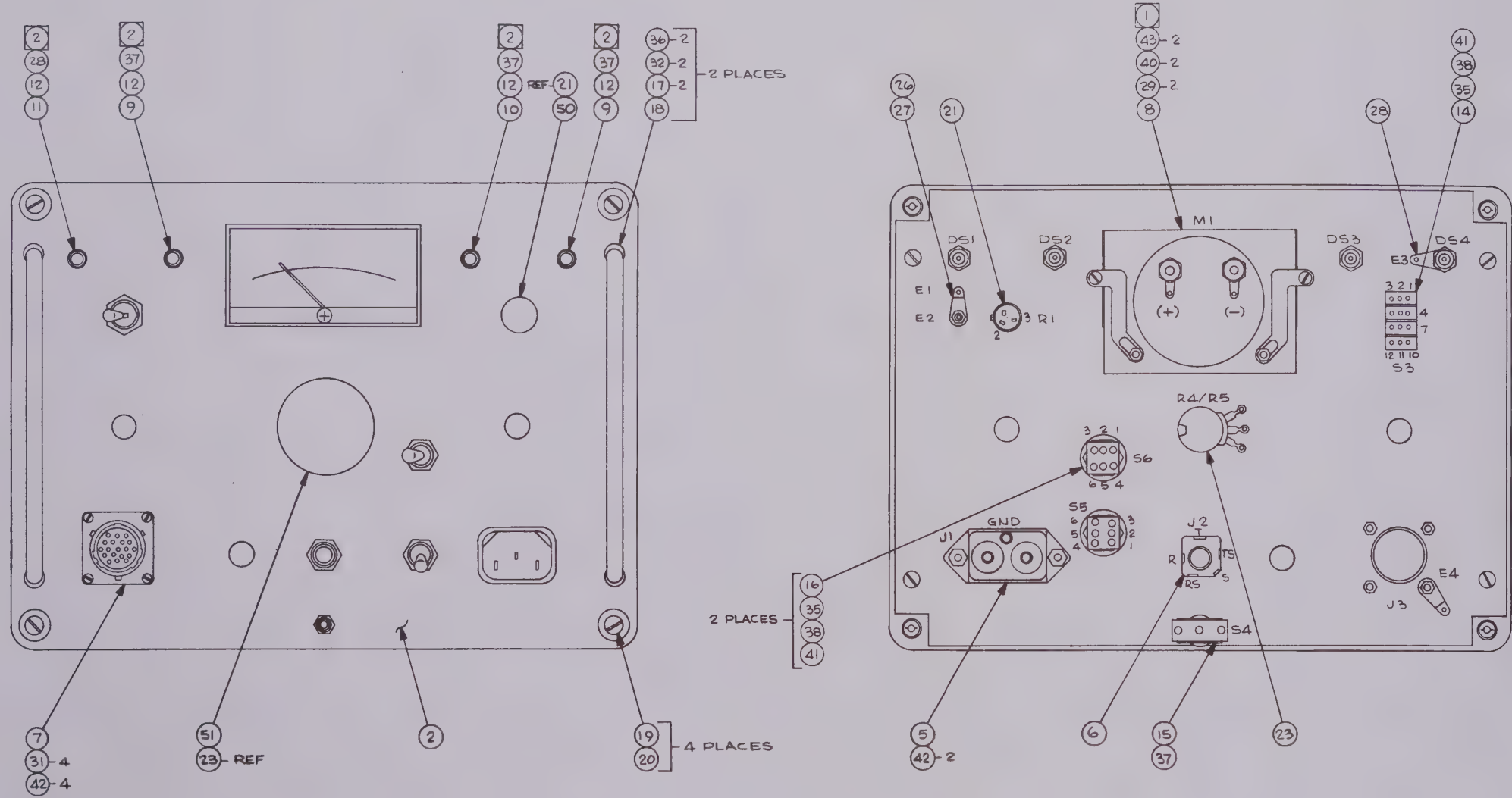
* PCB Hold Down Bracket

* C03274500

10/2 *TO NOTES*
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REVISIONS				
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B		PRODUCTION RELEASE	2/14/78	
C		ECO 16932 (REDRAWN)	6/6/78	DB
D		ECO 17890 (S/N: 1126 & ON)	9/9/81	
E		ECO 17875A (S/N: 697 & ON)	9/2/81	



- NOTES:
- 1 APPLY VC3 OR EQUIV TO THE METER MOUNTING SCREWS OF M1 PRIOR TO ASSY.
 - 2 INSTALL ITEM 12 (LAMP) AFTER SOLDERING WIRES TO DS1, DS2, DS3, DS4.

FOR LIST OF MAT'L SEE A03276300

QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A; INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED.					FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.		DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.	
							Sierra CODE IDENT. NO.	
							LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION MENLO PARK, CALIFORNIA 94025	
							54778	
							PANEL ASSY, FRONT	
							TOLERANCE UNLESS SPECIFIED	
							BASIC TWO PLACE THREE PLACE	
							UP TO 6 ± .02 ±	
							6 TO 24 ± .03 ±	
							ABOVE 24 ± .04 ±	
							ANGULAR DIMENSION ±	
							FINISH:	
REF. A03276300 413A					DATE 6/27/78		SIZE DRAWING NO.	
QTY. NEXT					BY D. BRUCE		D D03276400	
ASSY. OR ITEM					CHECKED 7/9/78		E	
APPLICATION					SCALE 1/1		SHEET 1 OF 4	

FP	ASSY. FRONT PANEL 413A	003276400
DS 1	LAMPHOLDER ULTRA-MINI RED	913800062
DS 2	LAMPHOLDER ULTRA-MINI GREEN	913800061
DS 3	LAMPHOLDER ULTRA-MINI RED	913800062
DS 4	LAMPHOLDER WHITE	913800063
E 1	SOLDER LUG #4 LOCKING	918400013
E 2	STANDOFF INSOLATED	915100010
E 3	SOLDER LUG 1/4 IN LOCKING	913400028
E 4	SOLDER LUG #10 LOCKING	913400029
FP12	LAMP INCANDESCENT TI FLANGE BASE 5V	913800060
J 1	RECEPTACLE AC	910100183
J 2	JACK PHONE 310	914400024
J 3	ASSY CONNECTOR	C03284700
J 4	CONNECTOR 2 PIN	914800243
M 1	METER	911800164
R 1	RES. 1000 OHM POT	907900129
R 2	RES. 5.1K 1/4W 5%	906900512
R 3	RES. 5.1K 1/4W 5%	906900512
R 4	RES. DUAL 2.5K OHM 1/2W 10% POT	907910252
R 5	RES. DUAL 2.5K OHM 1/2W 10% POT	907910252
S 3	SWITCH TOGGLE 4PDT	911000084
S 4	SWITCH PUSHBUTTON	911300060
S 5	SWITCH TOGGLE DPDT	911000068
S 6	SWITCH TOGGLE DPDT	911000068
VR 1	DIODE ZENER 1N751 5.1V	910630751
X 1	SCREW 4-40X 7/16	800004087
X 2	RETAINER	917300416
X 3	HANDLE 5 IN	918100041
X 4	FERRULE	921200088
X 5	TERMINAL	914800244

*Bazel

* 920400032

*Battery Cutoff Bracket in Lid

* CØ 2949600

* a e i r Spring in Lid

* 918300030

SEVEN
NOTES

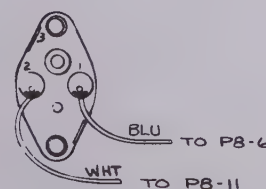
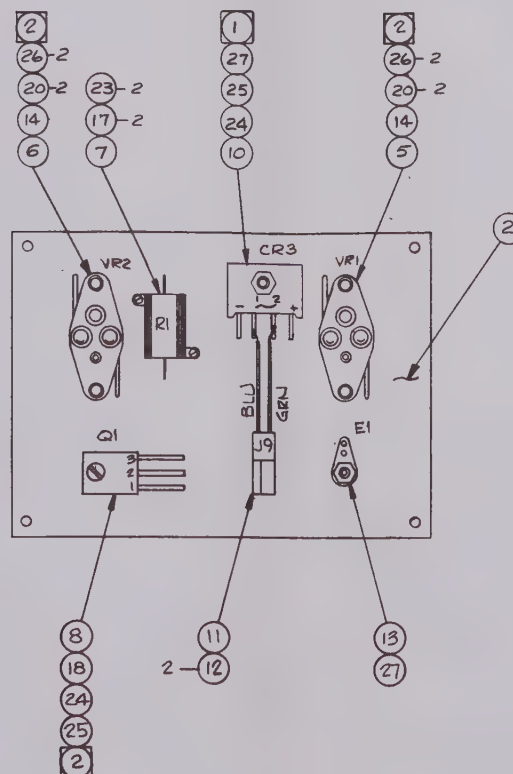
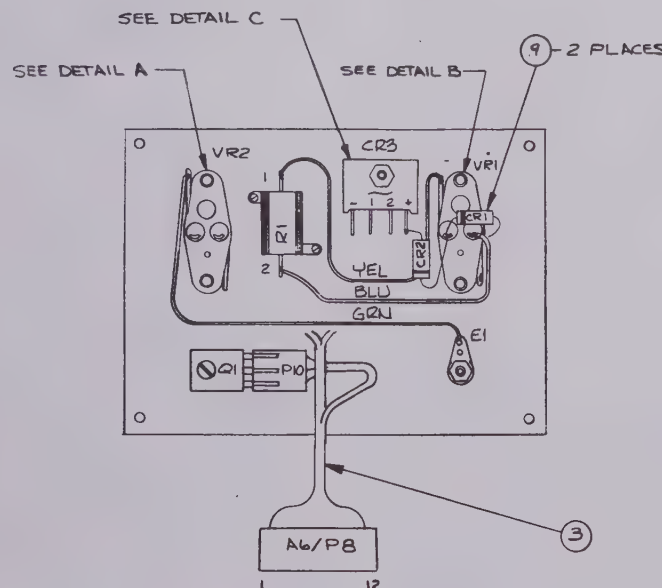
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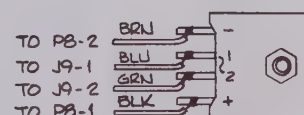
		REVISIONS	
ZONE	LTR	DESCRIPTION	DATE
	A	PILOT RUN - RELEASE	8/9/77
	A ₁	PCO 2408	1/12/78
	B	PRODUCTION RELEASE	2/14/78
	B ₁	ECO 17544 A	11/10/80



DETAIL A
OF VR2



DETAIL B
OF VR1



DETAIL C
OF CR3

WIRE ROUTING						
USE ITEM	WIRE NO.	COLOR	FROM	REMARKS	TO	REMARKS
3	—	BLK	A6/PB-1		CR3 (+)	
↑	—	BRN	A6/PB-2		CR3 (-)	
—	—	—	—		—	
—	—	—	—		—	
—	—	—	—		—	
—	—	BLU	A6/PB-6		VR2-1	
↓	—	—	A6/PB-7	KEYED	—	
3	—	GRN	A6/PB-8		E1	TACK SOLDER
30	3	GRN	E1		VR2-3	TACK SOLDER
3	—	VIO	A6/PB-9		VR1-1	TACK SOLDER
3	—	GRY	A6/PB-10		VR1-2	
3	—	WHT	A6/PB-11		VR2-2	
—	—	—	A6/PB-12		—	
29	1	YEL	R1-1		VR1-3	
31	5	BLU	R1-2		VR1-1	TACK SOLDER
9	—	—	VR1-1	SLEEVE LEADS	CR1 (ANODE)	
9	—	—	CR1 (CATHODE)		VR1-2	TACK SOLDER
9	—	—	VR1-2		CR2 (CATHODE)	
9	—	—	CR2 (ANODE)	SLEEVE LEADS	CR3 (+)	
3	—	—	P10		Q1	
31	4	BLU	CR3-1		J9-1	ATTACH ITEM 12
30	2	GRN	CR3-2		J9-2	ATTACH ITEM 12

FOR LIST OF MAT'L, SEE A03276700

NOTES:

- CUT TERMINAL POSTS OF CR3 TO .25 IN. LONG.
- APPLY A THERMAL HEATSINKING COMPOUND TO BOTH SIDES OF THE MICA WASHER FOR Q1, VR1, AND VR2.
- STRIP WIRES BACK .250 IN. UNLESS OTHERWISE NOTED.
- STRIP WIRES AT CONNECTOR J9 BACK .125 IN.

WIRE CUT LIST						
PART NO	COLOR	GAUGE	LENGTH	QTY	WIRE NO.	REMARKS
8136-0004	YEL	22	3.75	1	1	SEE NOTE 3
8136-0005	GRN	22	2.50	1	2	SEE NOTE 4
8136-0005	GRN	22	5.50	1	3	SEE NOTE 3
8136-0006	BLU	22	2.50	1	4	SEE NOTE 4
8136-0006	BLU	22	3.75	1	5	SEE NOTE 3

QTY.	QTY.	QTY.	QTY.	ITEM NO.	PART OR IDENTIFYING NO.	DESCRIPTION OR NOMENCLATURE	MATERIAL	SPEC OR NOTE
LIST OF MATERIAL OR PARTS LIST								
ALL THREADS UNIFIED SERIES, EXTERNAL THREADS TO BE CLASS 2A, INTERNAL THREADS TO BE CLASS 2B, AFTER PLATING, UNLESS OTHERWISE SPECIFIED.				FINISH ON ALL MACHINED SURFACES UNLESS OTHERWISE SPECIFIED. REMOVE ALL BURRS AND SHARP EDGES UNLESS OTHERWISE SPECIFIED.		DO NOT SCALE DWG. DIMENSIONS ARE IN INCHES AND INCLUDE PLATING THICKNESS UNLESS OTHERWISE SPECIFIED.		Sierra CODE IDENT. NO. 54778
						TOLERANCE UNLESS SPECIFIED		POWER SUPPLY PANEL
						BASIC TWO PLACE THREE PLACE		
						UP TO 6 ± .02 ±		
						6 TO 24 ± .03 ±		
						ABOVE 24 ± .06 ±		
						ANGULAR DIMENSION ±		
01 REF A03359100 413A-11				DATE 7/15/77		SIZE		DRAWING NO.
00 REF A03276700 413A				BY DWILLIS		D		D03276800
ASSY. OR ITEM				NEXT ASSY.		MODEL NO.		REV. B1
APPLICATION				FINISH:		SCALE 1/1		SHEET 1 OF 1

PP	ASSY. POWER PANEL 413A	003276800
CR 1	DIODE 1N4385	910804385
CR 2	DIODE 1N4385	910804385
CR 3	DIODE BRIDGE RECTIFIER	910800025
J 9	CONNECTOR 2 PIN	914800243
PP14	SOCKET T03	914200051
Q 1	TRANSISTOR MJE2955	910302955
R 1	RESISTOR WIREWOUND 3.0 OHM 5W 3%	906203R00
VR 1	IC LM317K VOLTAGE REGULATOR	920300317
VR 2	IC LM340K VOLT REGULATOR	920300340
X 1	WIRE 22 AWG BLU	813600006
X 2	WIRE 22AWG GRN	813600005
X 3	WIRE 22 AWG YEL	813600004
X 4	NUT 4-40 HEX	807501007
X 5	WASHER #6 SPLIT LOCK	819204021
X 6	WASHER #4 SPLIT LOCK	819204019
X 7	WASHER #4 FLAT	816504012
X 8	WASHER #2 SPLIT LOCK	819204017
X 9	SCREW 6-32 X 5/8	800004166
X 10	SCREW 4-40 X 3/8	800004086
X 11	SCREW 2-56 X 1/4	800004029
X 12	TERMINAL	914800244

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413A

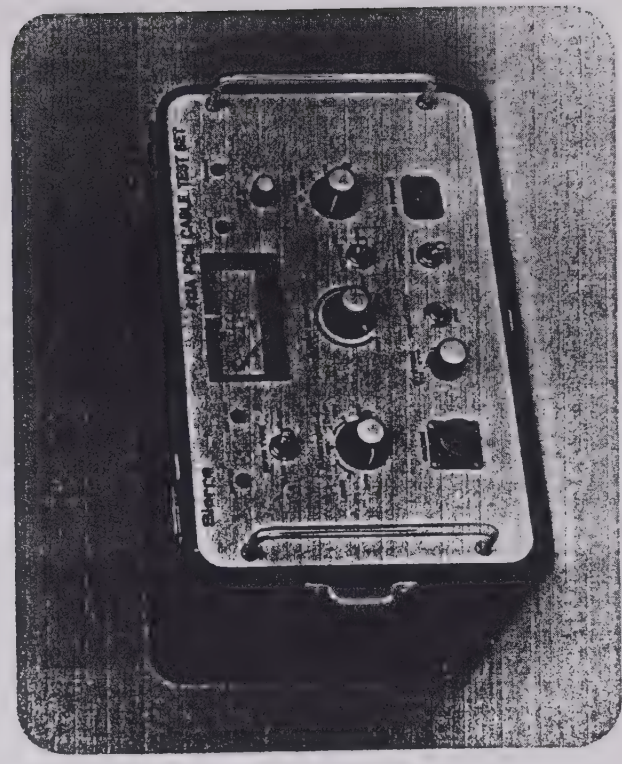
PCM CABLE TEST SET

OPERATION MANUAL

Sierra®
SI JENNINGS
A LEAR SIEGLER COMPANY
970 McLaughlin Ave.
San Jose, CA 95122
Tel. 408-292-4025
Telex 172385

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413A PCM CABLE TEST SET OPERATION MANUAL

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1. GENERAL

1.1 INTRODUCTION

The Sierra Model 413A PCM Cable Test Set is a portable battery or line powered instrument for pre-installation testing and field maintenance of PCM lines. It is designed to withstand the abuse of field operation where extremes of climate and environment are encountered.

The instrument provides for testing T1 (1.544 Mb/s) and T1C (3.152 Mb/s) type PCM lines.

The 413A measures Transmission Loss (dB) and provides a special reading for deriving Signal-to-Noise Margin. In addition, the set detects the presence of Pulses and Errors (BPV) in both Bridging and Terminating modes. As a Bridging Level Meter, the instrument provides for measuring cable loss on working PCM lines.

Two units are used to conduct a test, one as transmitter and one as receiver. (Each is capable of transmitting or receiving, but not at the same time.) The tests are performed on one section of cable, between repeaters or between an office and the adjacent repeater location. The signal transmitted contains spectral energy distribution similar to a normal PCM signal enabling the technician to determine if the performance of the cable pairs are within specified requirements.

In order to transmit PCM signals, the line must be completely free of the components which normally enhance a voice circuit (Figure 1-1). Loading coils and building-out capacitors, designed for voice frequencies, present formidable barriers to transmission of high frequency energy. Bridge taps are another source of trouble. Cable pairs or wires tapped on the PCM line can trap energy from the spectrum by acting as quarter wave stubs at critical frequencies.

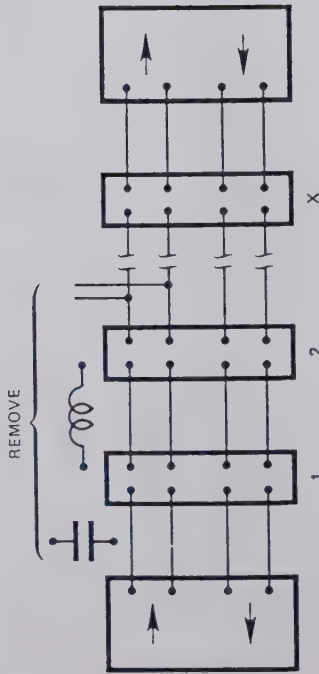
The engineer must also determine the best locations for the essential PCM Repeaters along the way. Existing manholes and cable poles, or new construction may be used.

NOTE: Since the 413A can read LOSS of 40 dB or more (see Specifications, Section 4), it can be used in "maximum span length" determination, to optimize location of new repeater housings.

Pre-installation tests are made on each cable sections between repeater locations. In Figure 1-2, one technician is at repeater location number 1; the other technician is at location number 2. Both 413As are equipped with optional probes designed to connect into a specific manufacturer's repeater housing. Another option is a test cord with a 310-type (tip-ring-sleeve) plug on the instrument end and an alligator or other type clip on the other end.

NOTE: Due to high frequencies involved in these tests, use shielded cords not longer than six feet.

Figure 1-1
Preparing Line for PCM



1.2 TESTING THE PCM LINE

At some point during assembly of the new PCM layout, the field personnel will test the cable sections for ability to handle PCM signals. They will also determine if the new system will degrade performance of other systems already in the cable. Tests can be made on "bare" cable pairs or at the new repeater housing itself. It measures cable loss with the PCM energy spectrum. It also detects errors (bipolar violations) in the PCM bit stream. In addition, it provides a special measurement from which a Signal-to-Noise Margin Value can be derived.

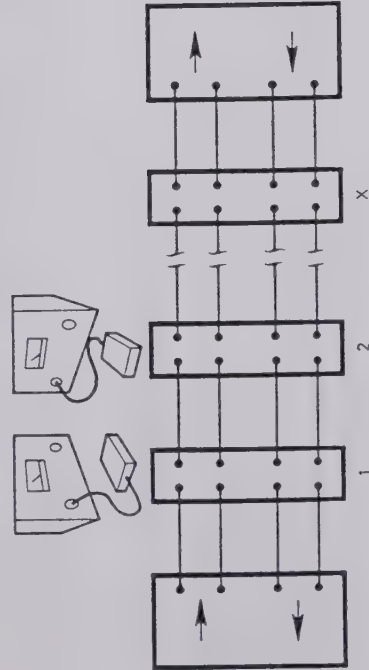


Figure 1-2
Testing at locations 1 and 2

1.3 CONNECTING THE 413A

The special probe (separately specified and ordered) connects the 413A directly into the slot to be occupied by the new repeater. It is mechanically designed for perfect fit and proper connection to a specific type of housing. The probe provides access to cable pairs in the normal direction transmission (Figure 1-3). Switch settings on each instrument, set up correct (send or receive) modes and select the appropriate pair. The 413A is capable of sending or receiving, depending on the normal direction of the pair under test. As shown in

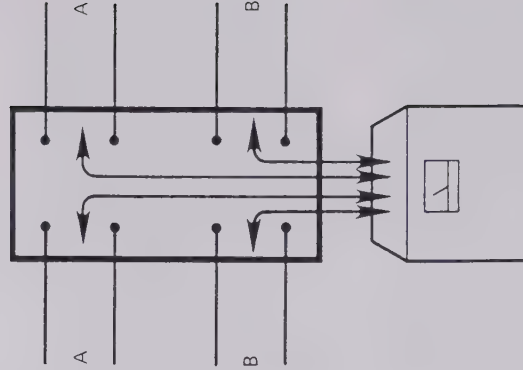


Figure 1-3
Probe Connection Provides Flexible Access to Lines

Figure 1-3, tests can be made in either direction from the repeater housing to an adjacent location. If the probe is used, pair selection is made by front panel switch. If the SEND/RCV jack is used, the test clips must be moved to the desired wires.

1.4 CALIBRATION

Prior to initial testing, both 413A test sets should be calibrated. When the FUNCTION switch is turned to CAL (Figure 1-4), the Transmitter is internally connected to the receiver via an artificial line.

The transmitter generates a signal with a standard Quasi-Random Word. This repetitive "word" consists of 1,048,575 bits which simulate the spectral energy distribution of a PCM line signal. By operating the SYSTEM selector (Figure 1-4), the technician can select the proper bit rate for the new system. Both signals (T1 and T1C) are continuous bipolar (AMI - Alternate Mark Inversion), i.e., each succeeding pulse is opposite in polarity. Prior to calibration, the desired system to be tested should be selected.

Throw the switch to LOSS (Figure 1-4). The meter circuit is now conditioned to measure level of the transmitter signal. The CABLE LOSS selector is set to its 30 dB (CAL) position. The LOSS CAL control is adjusted until the METER pointer reads the CAL point (2 dB). Total loss is 30 dB + 2 dB, or 32 dB. The receiver is now calibrated. Observe that the meter reads *increasing loss* as the pointer moves from left to right. The 413A is now ready for service.

1.5 ESTABLISHING CONTACT

Figure 1-4 shows the controls which establish contact with the distant test set. The RPTR (Repeater) TYPE switch is used only with a probe connected to the repeater housing. The FUNCTION selector operates in either the probe or test clip mode, although its purpose is somewhat simpler when making connection by clips directly on the cable pairs.

The two PCM cable pairs between each repeater location are typically designated Pair A and Pair B (Figure 1-5). Direction of

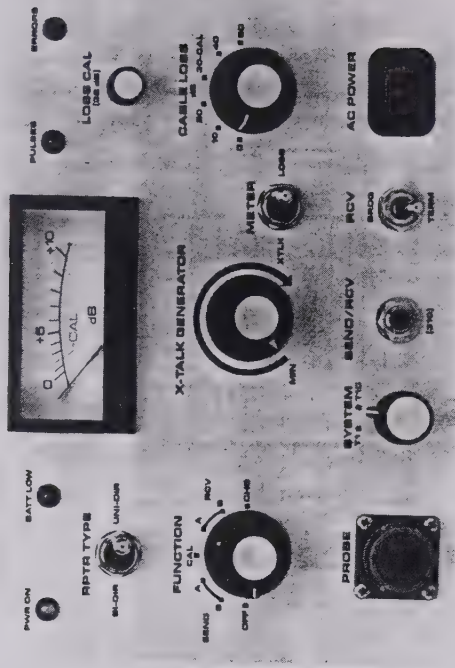


Figure 1-4
Front Panel Controls

normal transmission over the pairs is determined by the type of repeaters. In Bi-directional configuration, Pair A is the transmit path from Office A to Office B; Pair B is the reverse direction. In Uni-directional configuration (same direction of transmission for two separate systems) Pair A is unchanged; Pair B becomes the transmit direction of *another* PCM system from Office A to Office B. If a clip-type test cord is used (instead of a probe) the technicians establish contact by connecting directly to the desired pair. The FUNCTION selector on the Sending 413A is set to one of the SEND positions. ("Pair A" and "Pair B" designations are used only with the probe.)

When the probe is used, all four pairs are brought into the test set. It is important that the RPTR TYPE switch be positioned early and properly to prevent test signals from being sent in a direction opposite to normal transmission. This is particularly important if other PCM systems are working in the cable. A strong output test signal on a pair adjacent to the low level input pairs of working PCM systems may cause errors due to crosstalk coupling.

If the signal is too low, or doesn't arrive at all, the cable pair may be in trouble. Figure 1-7 illustrates some potential causes.

1. A *loading coil* may have been overlooked and remains on the line to choke off high frequency energy.
2. A *bridge tap* may have been overlooked. It acts as a trap to critical frequencies.
3. A *build out capacitor* may have been overlooked. Its capacitance shorts out the higher frequencies.
4. Perhaps water has entered the cable because of a crack in the sheath, reducing insulation resistance, increasing capacitance or increasing crosstalk.
5. The cable pair may be crossed with another circuit due to damaged insulation.
6. The cable pair may be open.
7. The cable pair may be shorted.
8. The cable pair may have high resistance leakage between wires, or between a wire and ground.

Figure 1-7
Examples of Line Troubles

The problem may in fact be a combination of two or more troubles. Whatever the cause, the technicians have the advantage of dealing with a cable pair only a few thousand feet in length between the repeater locations. Standard cable testing procedures should resolve the problem.

1.7 DETECTING BIPOLAR VIOLATIONS

The 413A transmitter generates a test signal similar to a normal PCM carrier bit stream. The basic PCM concept is a *bipolar* pulse train which alternates between Positive and Negative pulses (Figure 1-8). An error, called a Bipolar Violation, occurs if an extra pulse appears in the train, for it will likely be preceded or followed by a pulse of the *same* polarity. If a pulse is *lost* from the train, the following pulse will likely be identical to the one that precedes it. The 413A detects these signal errors and flashes the ERRORS indicator.

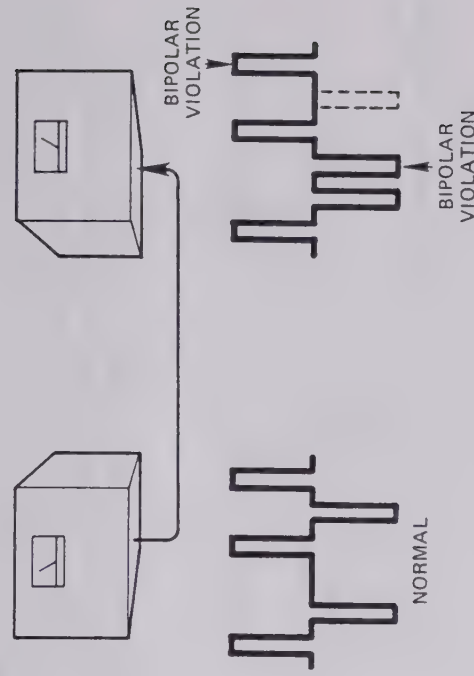


Figure 1-8
Bipolar Violation (Errors)

Because the 413A generates its own signal for pre-installation testing, both bit rates include strict bipolar progression. Therefore, errors can be detected without the need to automatically compensate for violations built in to some coding techniques.

1.8 ADVANTAGE OF QRW

Earlier cable test sets concentrated mainly on the overall *loss* of the cable section. Since maximum signal energy on a T1-type (1.544 Mb/s) system appears at 772 kHz, the test sets generated a single frequency generally close to 772 but sufficiently different to avoid interference with other systems in the same cable. Energy spectrum of the signal is very narrow. (See Figure 1-9, View A).

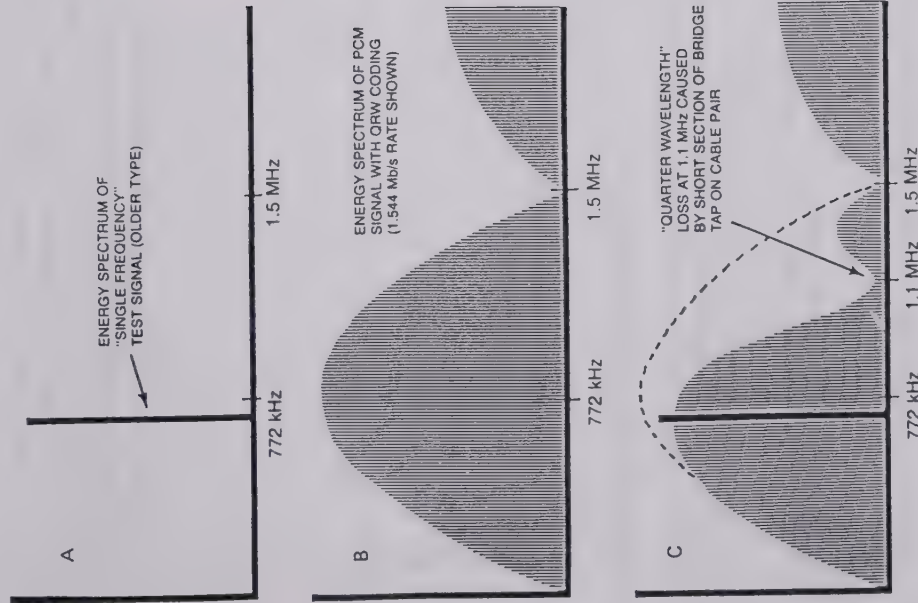


Figure 1-9
Advantage of QRW-Type Test Signal

A quasi-random work pattern (Figure 1-9, View B) is designed to "fill out" the energy spectrum similar to that of a normal PCM terminal-produced signal. Its broad energy spectrum detects cable troubles which might go undetected by earlier methods. Consider Figure 1-9, View C. An unremoved bridge tap, of a given length and characteristic, acts as a quarter-wavelength stub at 1.1 MHz. Energy is absorbed in the neighborhood of 1.1 MHz. Notice that a single frequency test tone near 772 KHz may be hardly affected. The QRW signal will likely lose a significant amount of its total energy, which will be detectable as excess cable loss.

1.9 CROSSTALK

The PCM signal with QRW not only permits detecting energy loss across the spectrum, but it is also responsive to the degrading influence of crosstalk. Figure 1-10, View A, shows one of the basic forms of crosstalk coupling: the inductive effects of signals on nearby circuits. Crosstalk can also be caused by direct coupling due to poor insulation, moisture, damage, etc.

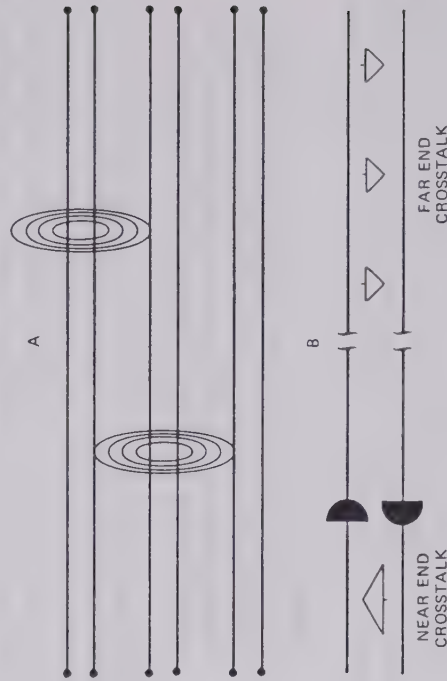


Figure 1-10
Crosstalk Interface (Examples)

Two types of crosstalk combine to limit the number of systems which can operate in the same cable. NEAR END crosstalk is the powerful coupling effect between two circuits with widely differing signal levels (Figure 1-10, View B). It is most likely to

occur in the wiring and cable in or near a repeater point, where the strong output of one repeater segment is in close proximity to the low level input to another repeater segment. FAR END crosstalk refers to energy coupled between circuits as the signal moves along the line. If crosstalk is strong enough, signal errors will be introduced.

The sharp PCM pulses that leave the Terminal Office or Repeater location (Figure 1-11, View A) are quickly attenuated and distorted as they travel along the cable (Figure 1-11, View B). Crosstalk coupling makes the situation worse. Also, impulse noise produces spikes of energy (Figure 1-11, View C) that can mask pulses so that the receiving terminal or repeater may make the wrong decision. An incorrect decision causes an error.



Figure 1-11
Effects of Crosstalk

1.10 SIGNAL-TO-NOISE MARGIN

Since T-carrier system engineering rules are very conservative, almost no transmission problems are encountered if the cable has been "cleared" properly and is in "average" condition. Thus, a single go/no-go test consisting of transmitting and detecting a QRW signal is generally sufficient to establish that the pair in question is acceptable for T-carrier use. Two significant changes in recent years have altered this situation somewhat:

1. T1 routes are reaching their design capacity, which makes it important to know just how much "margin" is left rather than just establishing a go/no-go test. A marginal situation could result in excessive error rates in existing systems.

2. The T1C 48 channel systems require a better Signal/Noise ratio than does T1. T1C engineering rules are considerably more stringent insofar as crosstalk is concerned. Duobinary transmission systems are also more critical, requiring approximately 3 dB of additional margin in S/N ratio relative to the T1 requirement.

Thus some means of determining the "margin" in S/N is desirable.

The primary purpose of the Signal-to-Noise Margin test is to establish whether or not the cable pair under test has an adequate signal-to-noise ratio to carry PCM. The test determines the amount of noise *which can be added* to the crosstalk already present in the pair under test before an "average good" PCM repeater would start to produce errors at an excessive rate. A special "noise vs error rate" test is performed, producing a numerical value that is applied to the graph in Figure 1-14. The Signal-to-Noise Margin (dB) can then be interpreted from the graph. With this knowledge, it is possible to determine how many additional PCM systems can be added. For example, the S/N margin of a pair in a cable carrying *four* systems is 6 dB. The number of systems could be increased four times (i.e., to 16) before crosstalk would theoretically begin to produce an unacceptable error rate.

NOTE: Such a calculation assumes that crosstalk from added systems will couple to the same extent as that from existing systems -- a valid assumption for a large cable with working systems in more than one binder group.

Consider the actual test setup in Figure 1-12. The distant 413A is sending a QRW pattern on the pair under test. The signal arriving at the receiving 413A will be attenuated and distorted by the cable characteristics. It will probably contain a certain quantity of crosstalk noise coupled from other pairs in the cable.

(Figure 1-13) The measurement is made (in the CAL mode) by first establishing the REFERENCE Noise Level, i.e., the amount of *local noise* (from an internal generator) required to produce a given error rate with no external cable noise (the input is terminated). Local noise is increased by advancing the X-TALK

GENERATOR control until the predetermined error (flash) rate is observed on the ERRORS indicator. The REFERENCE reading will be noted on the meter. The FUNCTION selector is then set to receive the signal from the distant 413A via the desired cable pair. Any cable noise added to the local generator's noise will cause the ERRORS indicator to flash more rapidly. (Meter level is unchanged because it is a function of the X-TALK GENERATOR control.)

NOTE: With the SYSTEM switch set to T1 (1.544 Mb/s), 10^6 error performance is indicated by 1 flash every 2/3 second (approx.). With the SYSTEM switch set to T1C (3.152 Mb/s), 10^6 error performance is indicated by 1 flash every 1/3 second (approx.).

The X-TALK GENERATOR control is then turned CCW (reduce the level of internally generated noise) *until the original error (flash) rate is again achieved*. The meter reading at this point is "MEASURE". Subtracting MEASURE from REFERENCE results in the "NOISE VARIANCE" value which is then entered onto the vertical (Y) axis on the graph in Figure 1-14. By projecting a horizontal line from the Y-axis to the curve and a vertical line down the X-axis, the corresponding Signal-to-Noise Margin value (dB) can be read.

The performance of various repeaters may possibly be different from the ALBO regenerator in the 413A (which has an optimum S/N ratio of 21 dB). If this information is known, the difference may be added or subtracted from the calculated value. For duobinary transmission, the lower operating limit is a margin of approximately 3 dB.

The technique used in the 413A allows a fine grain measurement of S/N margin in the area ranging from 8 dB down to 1 dB. If the margin is greater than 8 dB (common for a "good" cable pair) the crosstalk is so low that its effects are negligible. If the margin is less than 1 dB, *very little additional crosstalk can be tolerated*

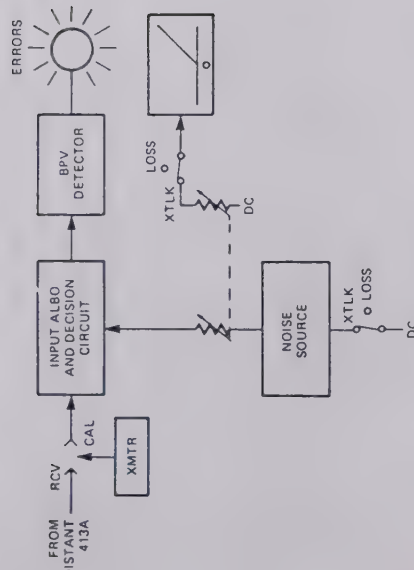


Figure 1-12
S/N Margin Test Configuration

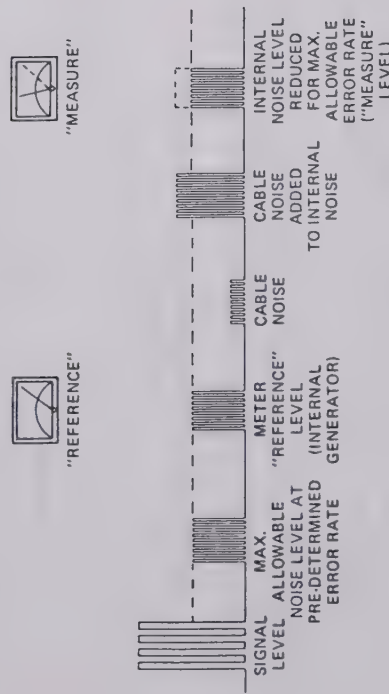


Figure 1-13
S/N Margin Test

1.12 BRIDGING MEASUREMENTS

A feature of the 413A is its ability to detect pulses and bipolar violations (errors), as well as measure cable loss, on a working and terminated PCM line (Figure 1-15). Bridging measurements on working PCM lines can be used to validate the working line, or to compare and verify loss readings taken on other lines being tested.

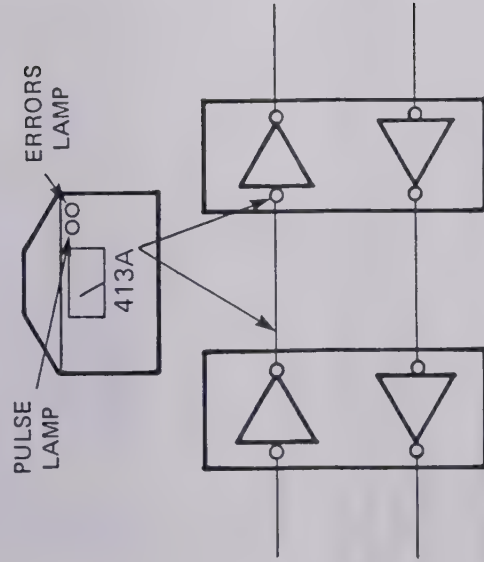


Figure 1-15

Bridging Error Detection and Loss Measurement

Bridging tests are performed through the SEND/RCV 310 jack using test leads to connect to the circuit to be tested with alligator clips where access to the cable pair is provided.

The PULSES indicator will light when signal is present and the ERRORS indicator will light when bipolar violations are detected in the Bridging Mode. With the set calibrated and the RCV switch in BRDCG, Cable Loss measurements can be made as described in Section 1.6.

2. OPERATION

2.1 RECEIVING INFORMATION

When the test set is received, unpack and inspect it carefully. Retain the shipping carton and packing material. Check the equipment received against the order.

CAUTION

The chrome plated bails on the front panel are designed primarily to protect the front panel controls and to aid in removing the instrument from its case. They were not designed for carrying or rough use. If the 413A is to be carried an appreciable distance it is recommended that the cover be placed on the instrument and the regular handle used.

2.2 CUSTOMER SERVICE

If the test set is found to be damaged or does not operate properly, or if the contents of the shipment are not complete, contact the Sierra Customer Service Department for information and instructions. See Section 5.2.

2.3 POWER REQUIREMENTS

The 413A may be operated from 115/230 volt AC power at 47 to 63 Hz, or from a NiCad rechargeable battery pack. Be sure the AC power switch is set for the correct voltage, 115 or 230. The voltage switch and fuses are located inside the case on the chassis assembly.

To access voltage switch and fuses, use the first few steps under "Battery Installation", Section 2.4.

WARNING

Turn the power off (by turning FUNCTION selector to OFF) and disconnect the AC power cord before removing the chassis from the case.

The voltage switch and AC fuse are located on the right panel of the chassis assembly (see Figure 2-1). The voltage switch is a slide-type switch which can be actuated by a small screwdriver blade. The BATTERY fuse is attached to the battery pack assembly. A spare fuse is provided.

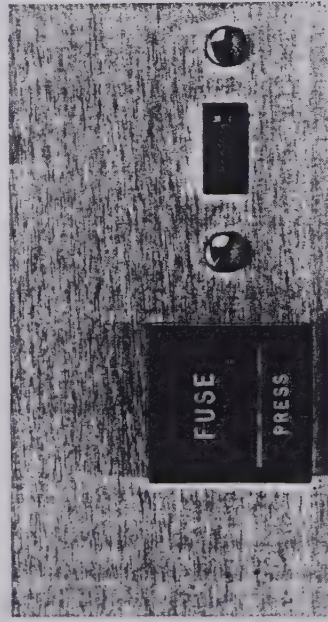


Figure 2-1
Fuse and AC Power Selector

2.4 BATTERY INSTALLATION

A rechargeable NiCad battery pack is included with the set and packaged separately in the shipping carton. To install the battery pack, remove the lid, set the FUNCTION Switch to OFF and proceed as follows:

1. Loosen the four quarter-turn fasteners at the corners of the bottom of the case.
2. Carefully pull the chassis out of the case.
3. Carefully place the chassis on its bails so that the bottom of the chassis is facing up. (See Figure 2-2.)
4. Remove the four screws and washers on the Battery Cover.
5. Remove the Battery Cover.
6. Place the NiCad battery pack in its compartment with the wires facing up and on the same side as the chassis-to-battery power connector.

7. The NiCad battery pack comes with a piece of foam rubber for protection. Place the foam rubber over the battery pack.
8. Replace the Battery Cover on the Chassis Attach Bracket.
9. Replace the four screws and washers on the Battery Cover.
10. Plug the chassis connector into the jack on the battery pack.
11. Gently slide the chassis back into the case, making sure that the battery pack cable is not pinched.
12. Tighten the four quarter-turn fasteners.

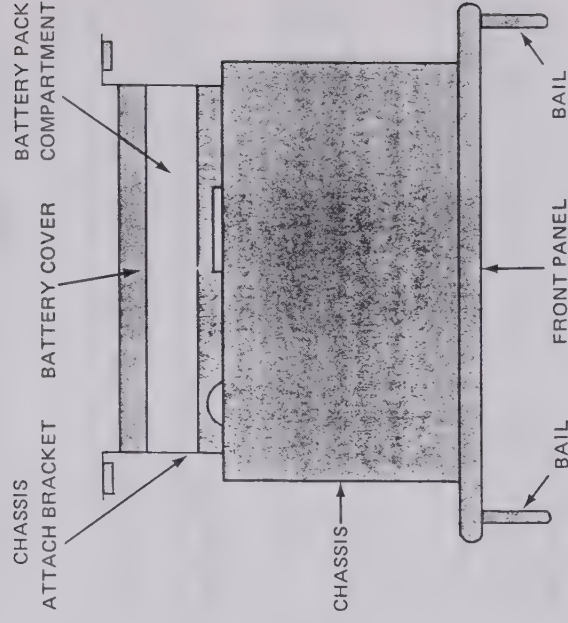


Figure 2-2
413A Chassis Lying on its Bails

2.5 POWER ON AND CHARGING

Power is turned on by rotating the FUNCTION selector from its OFF position to the desired position. When the AC power cord is connected, the 413A will operate on AC power. When the cord is disconnected, the instrument automatically switches to battery power.

The NiCad battery pack should be charged for 14 hours initially and each time thereafter when they become discharged, as shown by the BATT LOW indicator. During normal battery operation this indicator remains off. As the batteries approach the end of their usable power, the indicator will flash on and off repeatedly to show that 20 to 40 minutes of use remain before the test set will be cut off entirely. At cut-off time the indicator will light steadily. If the 413A power (FUNCTION) selector is turned OFF during the 20 to 40 minute warning time, it will not be usable again on battery power without recharging. The instrument is immediately usable, however, on AC power. When convenient, recharge the batteries by connecting the AC power cord and turning the FUNCTION selector to CHG for the specified 14 hours.

Test connections between the 413A and external circuits may be made in two ways:

1. A separate, special Probe designed to connect to a specific manufacturer's PCM repeater housing (attaches to the PROBE input connector on the front panel).
2. A test cord with a 310-type (tip-ring-sleeve) plug on the instrument end, and alligator clips or other suitable connector on the other end (attaches to the SEND/RCV jack on the front panel). Test cords more than 6 feet long are not recommended for PCM testing.

2.6 PRE-TEST PROCEDURES

To prepare the 413A for testing, use the following procedure:

1. If AC power is to be used, connect power cord. If battery power is to be used at remote sites, the NiCad battery pack should have been previously charged to full capacity.

2. Set SYSTEM selector to the type of system under test (T1 or T1C).

NOTE: Repeat the following steps if SYSTEM selector is changed.

3. Turn FUNCTION selector to CAL. (Turns instrument on and connects transmitter to receiver internally.)
4. Turn CABLE LOSS selector to "30-CAL" position (Sets receiver to proper loss calibration range.)
5. Set RCV switch to TERM
6. Set METER switch to LOSS.
7. Adjust LOSS CAL control until meter pointer rests on CAL line (+2 dB line). Receiver is now calibrated to the transmitter. A 32 dB internal artificial line appears in the signal path, hence the 32 dB Cal point on the meter.

NOTE: The meter is designed to read loss (in dB) in a "positive" direction. Observe that the meter pointer moves to the right as loss is increased.

8. The 413A is now ready for tests. Leave all controls in present positions. They will be changed as tests proceed.

2.7 INITIAL SETUP FOR CABLE PAIR TESTING

Establish voice communications with the technician at the other location, and use the following procedure:

1. If tests are to be made directly on cable pairs, insert a shielded test cord in the SEND/RCV jack and attach the other end to the desired cable pair (via alligator clips or other suitable connectors). (The technician at the other end of the cable section will do likewise.)
2. Determine which testing location will SEND. At this location move the FUNCTION selector to either one of the SEND positions (PAIR A or B). The instrument is now conditioned to transmit via the SEND/RCV jack.

3. At the other test location, move the FUNCTION selector to either one of the RCV positions (PAIR A or B). This instrument is now conditioned to receive via the SEND/RCV jack.
4. When tests (described later) are completed on a given pair, the test cords may be moved to the next pair.

NOTE: If the cable loss is less than 6 dB, erroneous readings may be obtained at the receiving test set location.

2.8 INITIAL SETUP FOR TESTING WITH PROBE

Establish voice communications with the technician at the other location. If tests are to be made at the repeater housing, a special Probe is required, designed for the specific manufacturer's housing. The Probe is usually carried in a compartment in the case cover. Use the following procedure:

1. Attach the Probe cable connector to the multi-conductor PROBE jack.
2. Insert the Probe into the housing normally occupied by the system repeater.
3. Determine the type of repeater arrangement used on the PCM system (Bi-Directional or Uni-Directional). Select the correct position of the RPRT TYPE switch.
4. Determine which location will initially Send and which will Receive. Sending location: turn the FUNCTION selector to SEND/PAIR A. Receiving location: turn the FUNCTION selector to RECEIVE/PAIR A.

2.9 CABLE LOSS MEASUREMENT

At the receiving end, set the 413A as follows:

1. CABLE LOSS selector 0
METER switch LOSS

2. Turn CABLE LOSS selector to a higher value until a reading is obtained between zero and 10 on the meter.

3. Determine total loss by adding the meter reading to the setting of the CABLE LOSS selector.

NOTE: If the signal is arriving, the PULSES indicator should be lighted. If the PULSES indicator is not lighted, check all settings of both 413As. See Section 1.1 for more information.

NOTE: When testing requires the use of the WECO adapter type ED 3C583-3-G1 (326A), set the RCV switch as follows:

413A at sending end: set to BRDG.
413A at receiving end: set to TERM.

When the LOSS test is complete, check reading against value predicted for the cable section. If out of limits, test cable and wiring for defects, using standard procedures. (If other pairs in the section have been prepared for PCM use, they might be checked to see if the out of limits loss is consistent.)

2.10 TESTING SECTIONS OF 10 dB OR LESS

When testing short end-sections in the range of 10 dB or less, greater accuracy can be obtained by matching two 413A test sets to each other. While accuracy of ± 1 dB can be expected with the 413A, matching two test sets first will produce an accuracy of better than ± 0.5 dB.

Use the following procedure to match two 413A test sets:

1. Using a 310-to-310 patch cord, connect the two 413As to each other at the SEND/RCV jacks.

2. Set each 413A as follows:

METER switch	LOSS
RCV switch	TERM
CABLE LOSS selector	0
SYSTEM selector	T1 or T1C (same on both)

Determine which set is to be Unit No. 1 and which is to be Unit No. 2.

3. On Unit No. 1, set the FUNCTION selector to SEND A.
On Unit No. 2, set the FUNCTION selector to RCV A.
4. On Unit No. 2, adjust the LOSS CAL control for a meter reading of 0 dB.
5. On Unit No. 1, set the FUNCTION selector to RCV A.
On Unit No. 2, set the FUNCTION selector to SEND A.
6. On Unit No. 1, adjust the LOSS CAL control for a meter reading of 0 dB.
7. Remove the 310-to-310 patch cord.

The two 413A test sets are now a "matched pair" in the 0 dB to 10 dB range. The settings of the LOSS CAL control should be recorded for Unit No. 1 and Unit No. 2 for reference, in case either control is accidentally nudged thereby destroying the reference calibration. With this reference it is now a simple matter to reset the LOSS CAL controls if either is accidentally changed.

Make the following measurements on the "matched pair" before using them on Cable Loss Measurements (Section 2.9). This information can be used when making future measurements.

1. Set each 413A as follows:

FUNCTION selector	CAL
CABLE LOSS selector	30-CAL
LOSS CAL control	DO NOT MOVE!

2. Read and record the position of the needle on the meter scale.

Once a set of corresponding meter readings are obtained on a "matched pair," these settings can be used when it is desired to achieve an accuracy of ± 0.5 dB or better to subsequent Cable Loss Measurements. Simply set up the test and adjust the LOSS CAL control so that each 413A gives the setting recorded above.

2.11 SIGNAL-TO-NOISE MARGIN TEST

With the far end location still sending, the initial setup of the receiving-end controls is as follows:

1. Turn X-TALK GENERATOR control fully CCW.
2. Set METER switch to XTLK.
3. Turn FUNCTION selector to CAL (terminates set and disconnects cable pair internally).

NOTE: All other controls should remain in positions set in previous tests.

The REFERENCE level is established by turning the X-TALK GENERATOR control in a CW direction (to approx. 8 dB) while observing the ERRORS indicator until it flashes at the prescribed Error (Flash) Rate.

NOTE: Flashing *rate* is important. (As the X-TALK GENERATOR control is advanced in a CW direction, the rate should tend to increase.) Example: System switch is setting at T1 (1,544 Mb/s) - 10^6 error performance is indicated by 1 flash every $2/3$ second (approx.). SYSTEM selector setting at T1C (3,152 Mb/s) - 10^6 error performance indicated by 1 flash every $1/3$ second (approx.). The operator's engineering department may specify adjustment until a specific errors (flash) rate is observed. If none is specified, a convenient flash rate of 1 error per second can be used for T1.

Record the reading on the meter at the specified errors flash rate. (This is the REFERENCE reading.)

The following steps add the cable crosstalk to obtain the MEASURE reading.

1. Turn FUNCTION selector to RCV A.

NOTE: The meter is a function of the X-TALK GENERATOR control (the reading will not change unless the generator control is turned).

2. *Slowly* turn X-TALK GENERATOR control in a CCW direction while observing ERRORS indicator until the prescribed flash rate is again attained.
3. Record the reading on the meter. (This is the MEASURE reading.) Subtract this reading from REFERENCE to obtain the NOISE VARIANCE value.

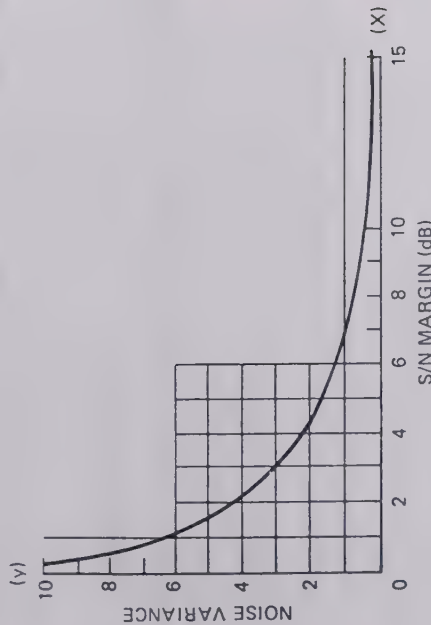


Figure 2-3
S/N Margin Calculations

This NOISE VARIANCE value is entered on the vertical (Y) axis of the graph in Figure 2-3. By drawing a horizontal line to the curve in the graph, and a vertical line from the curve down, the Signal-to-Noise Margin (dB) can be read on the X-axis.

Suitability of the cable pair will depend upon criteria established by the operator's engineering department or supervisor. Section 1 discusses significance of Signal-to-Noise Margin readings.

Perform identical tests, above, on Pair B. Sending location: turn FUNCTION selector to SEND (on) PAIR B. Receiving location: turn FUNCTION selector to RCV (on) PAIR B. Record results of tests.

When all tests are completed, turn the FUNCTION selector to OFF, remove the Probe or Test Cord, remove the AC cord (if powered by AC), store cords in the cover compartment, and close the cover.

NOTE: Each 413A has a CABLE LOSS measurement accuracy of ± 1 dB. When making tests in opposite directions it is therefore possible to observe up to 2 dB difference in readings. Example: A 40 dB span could read 39 dB loss in one direction and 41 dB loss in the other direction. (This would not indicate faulty test equipment or cable pairs.)

2.12 GO/NO-GO TESTING OF MULTI-PAIR CABLES

If many pairs are to be tested, as in initial cable acceptance, a go/no-go S/N Margin test may be used. Once the set is calibrated for both LOSS and go/no-go S/N Margin, the tests can be made by simply changing the METER switch from one position to the other.

The set is calibrated for LOSS measurement as in Section 2.6. Calibration for the go/no-go S/N Margin test is as follows:

1. Establish the meter REFERENCE Value by completing steps in the first part of Section 2.11.
2. "Back off" (CCW) the X-TALK GENERATOR control (from REFERENCE on the meter) by exactly the amount of the NOISE VARIANCE value specified by the engineer. The set is now calibrated for the go/no-go S/N Margin test.

NOTE: As long as the calibration controls are not changed and the set is not powered OFF, the set should stay in calibration.

With the set calibrated and connected to a selected cable pair, the tests are performed as follows:

1. Turn FUNCTION selector to RCV A (A or B if using probe).
2. Set METER switch to LOSS. Turn CABLE LOSS selector to a higher or lower value until a meter reading between zero and 10 is obtained on the meter. Determine a total loss by adding the meter reading and the setting of the CABLE LOSS selector.

NOTE: PULSES indicator should light.

3. Set METER switch to XTLK and observe the ERRORS indicator. If the Flash rate of the ERRORS indicator exceeds the predetermined rate, the pair is a "no-go". If the flash rate is not exceeded, or the ERRORS indicator does not light, the pair is acceptable. (PULSES indicator must be lighted.)

NOTE: Before commencing the go/no-go S/N Margin test, it suggested that one pair be checked using the previously described S/N Margin test (Section 2.11).

2.13 BRIDGING TESTS

If the unit is used as a Bridging Error Detector and Level Meter, proceed as follows:

1. Connect a suitable test cord to the SEND/RCV jack.
2. Turn power on by rotating FUNCTION selector to RCV A. Power indicator should light.
3. Set the RCV switch to BRDG.

CAUTION

When connecting the 413A to a working PCM line the RCV switch must be in the BRDG position to prevent shutdown of the line.

5. Connect the test set to the PCM cable pair, terminal block, repeater housing lugs, or other access point as applicable.
6. Set SYSTEM selector to type of system under test (T1 or T1C).
7. Observe PULSES and ERRORS indicators.
8. Cable loss measurements in the bridging mode can be performed as described in Section 2.9.
9. When tests are completed, turn FUNCTION selector to OFF and remove test cord.

3. PHYSICAL DESCRIPTION

3.1 General Appearance

The 413A is housed in a rugged portable carrying case. A cloth web shoulder strap is included for convenience of the operator in the field. Two metal strap guides are mounted on the carrying case. The strap and a removable AC power/battery charge cord are stored under a hinged panel in the cover. Operating controls and connections on the front panel are accessible when the cover is removed. Exceptions are the 115V/230V AC voltage switch, AC power fuse (see Figure 2-2) and battery fuse, which are accessible by removing the instrument from its case.

In addition to AC power, the 413A is arranged for operation from a rechargeable NiCad battery pack, which is located at the back of the chassis. (See 2.3 for installation instructions.)

The case cover is fully removable for convenience in the field. It has a storage space for probes and cords, accessible by turning the knob inside the cover.

3.2 CONTROLS, CONNECTORS AND INDICATORS

Operating controls and indicators are shown in Figure 3-1, and are identified and described in Table 3-1.

Table 3-1. Controls, Connectors and Indicators

Index No.	Name	Function
1	PWR ON indicator	Indicates test set power is on.
2	RPTR TYPE switch	Conditions test set to accommodate bi-directional (BI-DIR) or uni-directional (UNI-DIR) repeater wiring. (When properly selected, prevents sending test signals in the wrong direction of transmission.)

Table 3-1. Controls, Connectors and Indicators (Continued)

Index No.	Name	Function
3	BATT LOW indicator	Flashes when 20-40 minutes of useable battery life remains. Lights steadily when batteries are discharged. (Test set automatically cuts off.)
4	Meter	Displays LOSS in dB as a positive value when METER switch (9) is set to LOSS; actual value is meter reading plus setting of CABLE LOSS control (8). Displays Cross-talk readings when METER switch is set to XTLK.
5	PULSES indicator	Lights when test signal is received from line under test.
6	ERRORS indicator	Lights when errors (bipolar violations) are present in the received signal.
7	LOSS CAL control	Calibrates 413A receiver to its own transmitter signal when the FUNCTION switch (16) is in the CAL position and METER switch (9) is set to LOSS.
8	CABLE LOSS selector	Adjusts receiver for on-scale Meter reading when METER switch (9) is positioned to LOSS.
9	METER switch	Conditions the Meter to read CROSSTALK NOISE or CABLE LOSS.
10	X-TALK GENERATOR control	Provides internal noise from 0 to 10 dB when METER switch is in the XTLK position.
11	115/230 VAC connector	Connector for AC primary power cord. (Voltage is selected by a switch visible on the back of the equipment when the case is removed.)
12	RCV switch	Selects BRDG (bridging) or TERM (105-Ohm terminated) input.

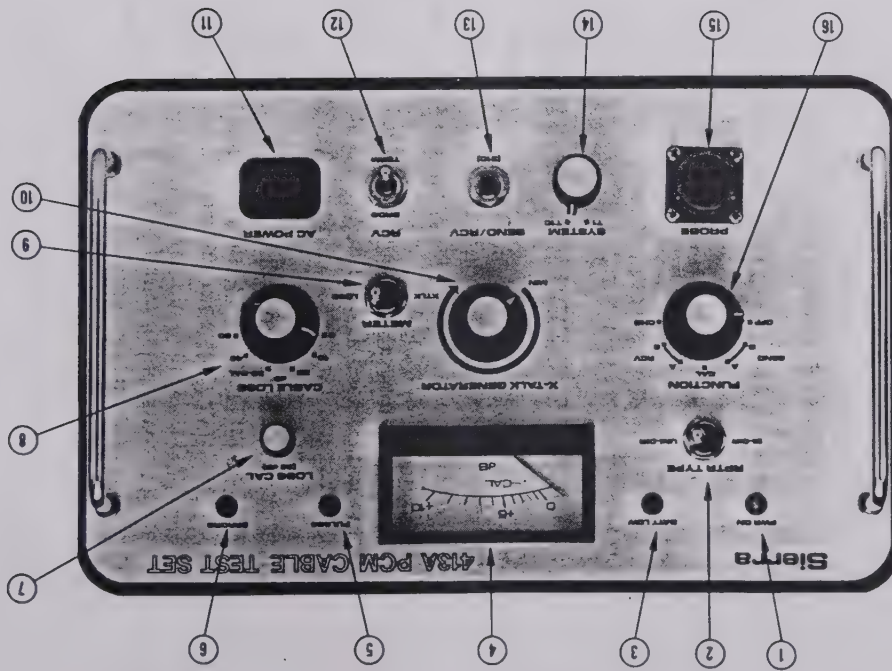


Figure 3-1. Front Panel

Table 3-1. Controls, Connectors and Indicators (Continued)

Index No.	Name	Function
13	SEND/RCV jack	Connector for 310-type plug when 413A is connected directly to the cable pairs via a test cord (with alligator or other type clips to attach to circuit).
14	SYSTEM selector	Selects correct bit rate for system desired: T1-1.544Mb/s T1C-3.152Mb/s
15	PROBE connector	Connector for optional special Probe. Used when 413A is connected to cable pairs via the repeater slot in a PCM repeater housing.
16	FUNCTION selector	Provides 5 functions in 7 positions: OFF removes power from the instrument; SEND (on) PAIR A/PAIR B conditions 413A to send on either of two pairs toward a distant 413A; CAL connects transmitter to receiver internally (through an artificial line) for calibration of receiver Cable Loss circuit; RCV (on) PAIR A/PAIR B conditions set to receive on either of two pairs from distant 413A; CHG causes the NiCad battery pack to recharge if test set is connected to AC power source.

4. SPECIFICATIONS

TRANSMITTER

Output Signal	Bipolar QRW
Bit Rates	T1: 1.544 Mb/s T1C: 3.152 Mb/s
Word Pattern	1.048 Mb quasi-random T1 has 14 zero suppression
Pulse Amplitude	$\pm 3V \pm 5\%$ base-to-peak
Overshoot	None
Duty Cycle	$50\% \pm 5\%$
Output Impedance	105 Ohms

RECEIVER

Input Signal	T1 or T1C
Input Range ($\pm 3V \pm 5\%$ b-p)	T1: 0 to 40 dB (at 772 kHz) T1C: 0 to 54 dB (at 1.576 MHz)
Meter Accuracy	T1: ± 1 dB T1C: ± 1 dB (0 to 50 dB range) ± 2 dB (50 to 54 dB range)

Crosstalk Generator Signal	PCM-shaped white noise
Meter Scale	0 to 10 dB

5.3 FUSE REPLACEMENT

The test set has two active fuses: one for AC power, and one for battery power. To access the fuses, remove the chassis from the case, as described in "Battery Installation" (Section 2.3). The AC fuse is located on the right hand side of the instrument chassis. The battery fuse is located on the battery cable. A spare fuse is provided.

If battery power appears to be lost, disconnect the battery cable and observe the active fuse. If blown, replace with the spare fuse. If the spare fuse also blows, and the cause cannot be determined (such as damaged insulation on the connecting wires, etc.), it is advisable to send the instrument to a Sierra repair facility.

If the battery fuse blows, the test set will not operate in the battery mode. It will operate, however, when the AC power cord is connected.

If AC power appears to be lost, remove and check the AC fuse located on the right side of the chassis.

If the AC fuse blows, the test set automatically switches to battery operation. If battery pack is installed and in good condition, the test set will continue to operate.

5.4 OPERATIONAL CHECKS

The LOSS measurement section of the set can be checked by performing the calibration procedure in Section 2.6.

The XTALK measurement section can be checked by performing the procedure for obtaining REFERENCE A, as in Section 2.11.

One 413A can be used to check another by connecting the sets directly to each other and using one to SEND and the other to RECEIVE. Note that meter accuracy is not defined unless an Artificial Line is connected between the two sets, but the check does assure that the sets are operational.

5.5 GENERAL TROUBLE CHECKS

Until the operator becomes familiar with the 413A, it is possible that some trouble conditions could, in fact, be operational problems. If troubles cannot be resolved, arrange to return the instrument. (See Section 5.2)

The following actions may be helpful:

Verify SYSTEM selector setting (T1 or T1C).

Verify METER switch setting (XTALK or LOSS).

Verify RCV switch setting (BRDG or TERM). In most cases, use TERM when testing new cable pairs, and BRDG when testing working pairs.

Set X-TALK GENERATOR control to full CCW position when not in use.

If contact is lost with the distant 413A, check settings for:

- (a) Correct repeater type (BI-DI or UNI-DI)
- (b) Correct pair (A or B)
- (c) Correct test function (SEND or RECEIVE)

If a power loss is experienced, check the fuses. If operating from a battery, verify that the battery has sufficient charge.

If the AC power fuse blows, check the AC VOLTAGE switch located on the right hand side of the chassis, near the AC fuse holder. Verify that it is set for the correct line voltage. (See Section 2.3)

5.6 CLEANING

The 413A can be cleaned with a soft damp cloth squeezed in a solution of 90% isopropyl alcohol and 10% water. Be careful not to moisten any wiring or electrical parts. Do not submerge the test set in the solution. Use a soft cloth to wipe dry after cleaning.

5.7 PARTS AND ACCESSORIES

Description

Sierra Part Number

Fuse: 3/4 Amp, 250 V, Slow Blow
(AC and Battery)

913800029

Battery Pack (15V 4.5 Amp-hr)
(rechargeable NiCad)

918500029

APPENDICES

Simplified Operating Instructions

A. Cable Pair Loss to Code Conversion

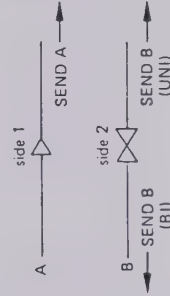
PAIR LOSS MEASUREMENT

CALIBRATION CHECK

1. Select SYSTEM.
2. Set FUNCTION to CAL.
3. Adjust LOSS CAL for 32 dB reading.

SET-UP

1. Sets are normally used in pairs but any standard ± 3 V BP signal source may be used as transmitter.
2. If test cord is used, switch FUNCTION to SEND or RCV, as required.
3. If apparatus case probe is used:
 - a) select RPTR TYPE
 - b) select test pair, A or B, and SEND or RCV.



MEASURE

1. Adjust CABLE LOSS for meter reading (dB).
2. Pair loss is sum of meter reading and CABLE LOSS setting. Loss code may be determined from table. T1 values are designated +/- ; TIC as LOW or HIGH.

919500513

TIC LOSS (dB)		CODE	T1 LOSS (dB)	MINUS/PLUS RANGE
LOW	HIGH			
33.4	55.2	A1	33.4	
31.0	52.8	A +	31.0	31.1 TO 32.2 29.9 TO 30.9
28.6	50.4	B +	28.6	28.7 TO 29.8 27.5 TO 28.5
26.2	48.0	C +	26.2	26.3 TO 27.4 25.1 TO 26.1
23.8	45.6	D +	23.8	23.9 TO 25.0 22.7 TO 23.7
21.4	43.1	E +	21.4	21.5 TO 22.6 20.3 TO 21.3
19.0	40.7	F +	19.0	19.1 TO 20.2 17.9 TO 18.9
16.6	38.3	G +	16.6	16.7 TO 17.8 15.5 TO 16.5
14.2	35.9	H +	14.2	14.3 TO 15.4 13.1 TO 14.1
11.7	33.5	J +	11.8	11.9 TO 13.0 10.7 TO 11.7
9.3	31.1	K +	9.4	9.5 TO 10.6 8.3 TO 9.3
6.9	28.7	L +	7.0	7.1 TO 8.2 5.9 TO 6.9
4.5	26.3	M +	4.6	4.7 TO 5.8 3.5 TO 4.5

B. Noise Margin

NOISE MARGIN MEASUREMENT

1. Set FUNCTION to CAL.
2. Set METER switch to XTLK.
3. Adjust XTLK control for flashing ERRORS indication (1 per second).
4. Read Reference level.
5. Set FUNCTION to RCV.
6. Re-adjust XTLK control for same flash rate as in (3).
7. Read Measure level.
8. Subtract Measure from Reference; (7) from (4).
9. Use this difference value to determine margin in Signal to Noise ratio from table.

DIFF. (dBX)	S/N MARGIN (dB)
0	> 20
0.5	10
1	7
1.5	5
2	4
3	3
4	2
5	1½
6	1+

WARRANTY

SIERRA - LSI JENNINGS warrants products manufactured by it to be free from defects in material and workmanship and to meet the applicable specifications under normal use and service for a period of 36 months from the date of original shipment by us. Our obligation under this limited warranty is confined to the repair or replacement of such products which, after having been returned to the factory or a point designated by us, shall be examined and in our sole opinion found defective and that such defect was not induced by causes external to the product. Alternatively, SIERRA may elect to issue credit for any such defective product. All products to be repaired or replaced shall be returned prepaid to the designated place of repair in accordance with authorization and packing and shipping instructions issued by SIERRA. Return shall not be made until such authorization and instructions are issued. Each returned product shall be accompanied by a statement or report fully stating the claimed defect and any other pertinent information concerning the failure.

SIERRA's responsibility under this limited warranty does not apply to any products which have been repaired, worked upon or altered by persons not authorized by us so as to in our sole judgement, injure the stability or reliability of such product, or which have been subject to misuse, negligence or accident; or where applicable, the serial number has been altered, effaced or removed. SIERRA shall not be liable for damages resulting from the use of the purchased product; nor shall SIERRA be responsible for any failure in the performance of other items to which the purchased product is connected or the functioning of an entire system or parts of any system of which the purchased product may be a part.

SIERRA reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make changes whatsoever on units previously purchased. Routine calibration and accessories, including but not limited to all vacuum tubes, fuses, pilot lamps and batteries used with our products are not covered by this limited warranty. A test setup charge will apply to any returned instrument which, after test, is found to meet the applicable specifications.

This limited warranty is in lieu of all other warranties, expressed, implied or statutory. No representative or person is authorized to represent nor assume for SIERRA any liability in connection with the sale of products other than set forth herein. IN NO EVENT SHALL SIERRA BE LIABLE FOR SPECIAL INCIDENTAL OR CONSEQUENTIAL DAMAGES.

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LSI JENNINGS
A LEAR SIEGLER COMPANY

970 McLaughlin Avenue
San Jose, California 95122
Phone 408-292-4025
Telex 172385



ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

NUMBER

DATE _____

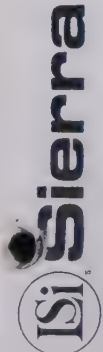
SHEET

17295

11/7/79

OF

EFFECTIVITY		S/N OR DATE		JOBS		MODELS		DOCUMENT NUMBER		AFFECTED DOCUMENT		CHANGE REV.											
MODEL	S/N OR DATE	AFFECTED	JOBS	AFFECTED	MODELS	DOCUMENT NUMBER	DESCRIPTION	FROM	TO														
413A	S/N 1014UP	J445	413A	C03276000	INSTRUCTION LABEL	B	C																
A. SUMMARY MFG. COST OF CHANGE \$ <u>2</u> B. EXPECTED M/LB CHANGE ☐ HIGHER ☐ LOWER \$ <u>2</u>																							
AFFECTED YES NO C. PERFORMANCE ☐ ☒ D. APPEARANCE ☐ ☒ E. INTERCHANGEABILITY ☐ ☒ F. SCHEDULE ☐ ☒ G. JOBS ☐ ☒ H. BOM ☐ ☒ I. TOOLING ☐ ☒ K. VISUAL AIDS ☐ ☒ L. OPERATION SHEET ☐ ☒ M. TEST PROCEDURE ☐ ☒ N. MANUAL ☐ ☒ P. PUBLISHED DATA ☐ ☒ R. FIXIT ☐ ☒																							
DISPOSITION CODE 1. INCORPORATE CHANGE 919500513 2. SCRAP (03276000 REV B) 3. USE AS IS																							
CODE X INGR <u>12/12/79</u> MFG. ENG <u>12/21</u> QA <u>12/21/79</u> DOC CONTROL <u>12/22/79</u>										CODE Y EX <u>12/19/79</u> SALES MKT OPER		DATE 12-12-79 12/21 12/20/79 12/22/79		DATE 12/19/79		CODE Z FINANCE PRESIDENT		DATE 11/17/79		ORIGIN BY INC. BY CHK. BY		NUMBER 17295	



ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER

NUMBER 1795
DATE 11/7/94
SHEET 2 OF 2

CO3276000

CHANGE:

INCORPORATE REVISED INFORMATION AS SHOWN.

WAS

IS

REV. C

8.88 REF
KEY. B

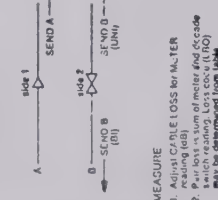
-.031 TYP
4 PLCS

-.031 TYP
4 PLCS

8.88 REF

PAIR LOSS MEASUREMENT
CALIBRATION CHECK
1. Select SYSTEM (METER)
2. Set FUNCTION to CAL.
3. Adjust CAL so that meter reads 32 dB

SET-UP
1. Sets are normally used in pairs but any one may be used as a reference source may be used as a transmitter.
2. If test cord is used, switch FUNCTION to SEND or RCV as required.
3. Select RPT RTYPE
a) Select test pair, A or B, and SEND or RCV.

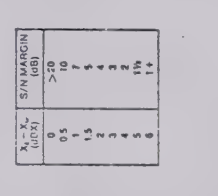


91500513

LO CODE	LOSS (dB)	PLUS/MINUS LOSS (dB)
A	31	29.9 TO 30.2
B	28.5	27.5 TO 29.5
C	20.2	19.3 TO 21.1
D	23.8	22.7 TO 25.0
E	21.4	20.3 TO 22.6
F	19.0	17.9 TO 20.2
G	16.6	15.5 TO 18.5
H	14.2	13.1 TO 15.4
J	11.3	10.2 TO 12.7
K	9.4	8.3 TO 10.9
L	7.0	5.9 TO 8.9
M	4.6	3.5 TO 4.5

NOISE MARGIN MEASUREMENT
1. Set FUNCTION to CAL.
2. Set METER switch to CROSS TALK
3. Adjust MARGIN control for flashing
4. Read Reference level (1 per second).

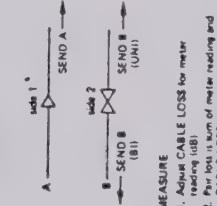
SET-UP
1. Sets are normally used in pairs but any one may be used as a reference source may be used as a transmitter.
2. If test cord is used, switch FUNCTION to SEND or RCV as required.
3. Select RPT RTYPE
a) Select test pair, A or B, and SEND or RCV.



91500513

PAIR LOSS MEASUREMENT
CALIBRATION CHECK
1. Select SYSTEM
2. Set FUNCTION to CAL.
3. Adjust LOSS CAL for 32 dB reading

SET-UP
1. Sets are normally used in pairs but any one may be used as a reference source may be used as a transmitter.
2. If test cord is used, switch FUNCTION to SEND or RCV as required.
3. Select RPT RTYPE
a) Select test pair, A or B, and SEND or RCV.

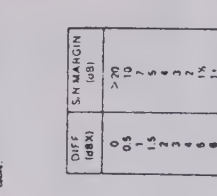


91500513

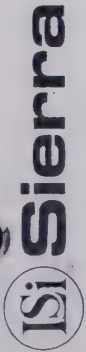
TTC LOSS (dB)	LOSS (dB)	MINUS PLUS RANGE
33.88	58.07	A1 33.8
31.42	53.82	A 31.0
28.06	51.10	B 28.5
20.56	48.69	C 20.7
21.15	48.20	D 23.9
21.09	43.83	E 21.5
19.23	41.37	F 19.0
18.94	39.01	G 18.6
14.48	36.56	H 14.2
12.02	34.10	J 11.8
8.87	31.70	K 8.4
7.21	29.24	L 7.0
4.86	26.78	M 4.6

NOISE MARGIN MEASUREMENT
1. Set FUNCTION to CAL.
2. Set METER switch to XTALK.
3. Adjust MARGIN control for flashing
4. Read Reference level (1 per second).

SET-UP
1. Sets are normally used in pairs but any one may be used as a reference source may be used as a transmitter.
2. If test cord is used, switch FUNCTION to SEND or RCV as required.
3. Select RPT RTYPE
a) Select test pair, A or B, and SEND or RCV.



91500513



SIERRA ELECTRONIC DIVISION.

ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

☒ ☐ ☐

NUMBER 17625
DATE 10-31-80
SHEET 1 OF 5

EFFECTIVITY		JOBS		MODELS		AFFECTED DOCUMENT		CHANGE REV.	
MODEL	S/N OR DATE	AFFECTED	AFFECTED	AFFECTED	DOCUMENT NUMBER	DESCRIPTION	FROM	TO	
413A	776 VP		7545 VP	413A	D03266400	A3 SCHEMATIC	C1	D	
413A-11	164 VP		7546 VP	413A-11	D032663800	A3 PUB ASSY L/M	C1	D	
					D03266700	A6 SCHEMATIC	C1	D	
					D03264100	A3 PUB MASTER ARTWORK	B1	C	
					D03264000	A3 PUB ORILL TRIM (9045X678)	B1	C	
					D03263900	A3 PUB ASSY	B1	C	
					D03265300	A6 PUB ARTMASTER	B1	C	
					D03265200	A6 DRILL & TRIM (9045X681)	B1	C	
					D03265100	A6 PUB ASSY	B1	C	
5122 REWORK INSTRUCTIONS ON SHEET 5									
REASON FOR CHANGE: 9TAD00122 PHASE WORK									
☐ MANUFACTURABILITY ☐ ERROR CORRECTION ☒ OTHER									
DISPOSITION CODE		PART NO.	DISPOSITION	STOCK	W.I.P.	TEST	COMPLETE	ON ORDER	
1. INCORPORATE CHANGE		904500678	✓	11	11	11	11	11	
2. SCRAP				11	11	11	11	11	
3. USE AS IS									
CODE X		DATE	CODE Y	DATE	CODE Z		ORIG. BY		
ENGR				10/31/80	FINANCE		INC. BY NGA LC		
MFG. ENG		10/31	SALES	10/31/80	PRESIDENT		CHK. BY DR Johnson 10/31		
QA		10/31/80	MKT		CLASSIFICATION CODE		NUMBER		
DOC CONTROL		10/31/80	OPER		A AC AR		17625		

ENGINEERING CHANGE ORDER
 ENGINEERING VARIANCE ORDER
 TYPE 1 CHANGE ORDER

☒ ☐ ☐

NUMBER 17025
 DATE 10-31-80
 SHEET 2 OF 5

A 03263800 A3 PWR ASSEY LHM

CHANGE FROM

^{FROM}
 14/8/ 906900242 / 2.4K 1/4W 5% / R426,27,39

13/8/ 906900242 / 2.4K 1/4W 5% / R4,26,27

CHANGE FROM

11/21/ 907304990 / 4995 1/8W 1% / R33

TO

11/21/ 907304960 / 1965 1/8W 1% / R33

D03266700 A6 SCHEMATIC

ADD TRACE FROM J3,L TO J4,L

ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

☒
☐
☐

NUMBER 11-25
DATE 10-31-80
SHEET 3 OF 5

D03266400 A3 SCHEMATIC

REMOVE Q1, Q2, R39, R2
ADD TRACE FROM C6 (OPEN END) TO PIN L

CHANGE R33 FROM 499 TO 196

A03263800 A3 PWB ASSY L/M

CHANGE FROM
13/45 / 910303904 / TRANS. 2N3904 / Q1,2,3

TO
11/45 / 910303904 / TRANS 2N3904 / Q3

CHANGE FROM
4/6 / 906900102 / RES 1K 1/4W 5% | R2,11,14,30

TO
13/6 / 906900102 / RES 1K 1/4W 5% | R11,14,30

ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

☒ ☐ ☐

NUMBER 17125
DATE 10-31-80
SHEET 4 OF 5

C03264100 A3 PWB MASTER ARTWORK
UPDATE PER A3 SCHEMATIC CHANGES

C03264000 A3 DRILL + TRIM
UPDATE PER A3 ARTWORK CHANGES

D03263900 A3 PWB ASSEMBLY
UPDATE PER A3 ARTWORK CHANGES

C03265300 A6 PWB MASTER ARTWORK
UPDATE PER A6 SCHEMATIC CHANGES

C03265200 A6 DRILL + TRIM
UPDATE PER A6 ARTWORK CHANGES

D03265100 A6 PWB ASSEMBLY
UPDATE PER A6 ARTWORK CHANGES

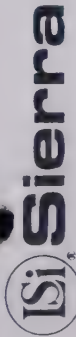
ENGINEERING CHANGE ORDER ☒
ENGINEERING VARIANCE ORDER ☐
TYPE 1 CHANGE ORDER ☐

NUMBER 17-25
DATE 10-31-80
SHEET 5 OF 5

REWORK INSTRUCTIONS

1. A3 REMOVE Q1, Q2, R2, R39
ADD JUMPER FROM CC (AT JUNCTION OF
R39, R2) TO PIN L

2. A6 ADD JUMPER FROM J3 PIN L TO J4 PIN L



SIERRA ELECTRONIC DIVISION.

ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

NUMBER 17625
DATE 11/25/81
SHEET 1 OF —

CHANGE REV.

FROM G TO G1

DESCRIPTION

DOCUMENT NUMBER

MODELS AFFECTED

JOB AFFECTED

EFFECTIVITY

MODEL S/N OR DATE

413A

415A11

A. SUMMARY MFG. COST
OF CHANGE \$ —
B. EXPECTED MFG. CHANGE
HIGHER ☐ LOWER ☐

AFFECTED YES NO

C. PERFORMANCE ☐

D. APPEARANCE ☐

E. INTERCHANGEABILITY ☐

F. SCHEDULE ☐

G. JOBS ☐

H. BOM ☐

J. TOOLING ☐

K. VISUAL AIDS ☐

L. OPERATION SHEET ☐

M. TEST PROCEDURE ☐

N. MANUAL ☐

P. PUBLISHED DATA ☐

R. FIXIT ☐

DISPOSITION CODE

1. INCORPORATE CHANGE

2. SCRAP

3. USE AS IS

CODE X

DATE

CODE Y

DATE

CODE Z

DATE

ORIG. BY

INC. BY

CHK. BY

ENGR

MFG. ENG

QA

DEC. CONTROL

12/1/81

12/1/81

12-2-81

ENGR

SALES

MKT

OPER

ENGR

SALES

MKT

OPER

DATE

DATE

DATE

FINANCE

PRESIDENT

CLASSIFICATION CODE

DATE

DATE

DATE

ORIG. BY

INC. BY

CHK. BY

DATE

DATE

DATE

DATE

DATE

DATE

ECO NOT FULLY INCORPORATED PRIOR TO PRINT
RELEASE. VELUM HAS BEEN CORRECTED.
L/M TO BE BROUGHT TO G1 TO IDENTIFY
CORRECTED LIST.

Per change only

*FIELD RETROFIT REQUIRED YES ☐ NO ☐ PLM —, EST. COST —, S/N —, TO —

REASON FOR CHANGE:

☐ MANUFACTURABILITY

☐ ERROR CORRECTION

☐ OTHER

PART NO.

DISPOSITION

STOCK

W.I.P.

TEST

COMPLETE

ON ORDER

OTHER

CODE X

DATE

CODE Y

DATE

CODE Z

DATE

ORIG. BY

INC. BY

CHK. BY

ENGR

MFG. ENG

QA

DEC. CONTROL

12/1/81

12/1/81

12-2-81

ENGR

SALES

MKT

OPER

ENGR

SALES

MKT

OPER

DATE

DATE

DATE

FINANCE

PRESIDENT

CLASSIFICATION CODE

DATE

DATE

DATE

ORIG. BY

INC. BY

CHK. BY

DATE

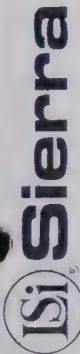
DATE

DATE

DATE

DATE

DATE



SIERRA ELECTRONIC DIVISION.

ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

NUMBER 18618
DATE 4-15-83
SHEET 1 OF 1

EFFECTIVITY		JOBS		MODELS		AFFECTED DOCUMENT		CHANGE REV.	
MODEL	S/N OR DATE	AFFECTED	AFFECTED	AFFECTED	DOCUMENT NUMBER	DESCRIPTION	FROM	TO	
413A	4-19-83	✓	1780	413A	CO3502900	INSTRUCTION LABEL SUPPLEMENTARY		A	
			1800	413A-11	A03274600	SPEC, PANEL METER ANALOG		B	
			1825		CO3276000	INSTRUCTION LABEL		E	
A. SUMMARY MFG. COST OF CHANGE \$ <u>10.10</u>									
B. EXPECTED MLB CHANGE ☒ HIGHER ☐ LOWER									
C. AFFECTED YES NO									
C. PERFORMANCE ☐ ☒									
D. APPEARANCE ☐ ☒									
E. INTERCHANGEABILITY ☐ ☒									
F. SCHEDULE ☐ ☒									
G. JOBS ☐ ☒									
H. BOM ☐ ☒									
I. TOOLING ☐ ☒									
K. VISUAL AIDS ☐ ☒									
L. OPERATION SHEET ☐ ☒									
M. TEST PROCEDURE ☐ ☒									
N. MANUAL ☐ ☒									
P. PUBLISHED DATA ☐ ☒									
R. FIXIT ☐ ☒									
REASON FOR CHANGE: LABEL SUPPLEMENTARY INSTRUCTIONS MARKETING INPUT. FRONT PANEL INCREASED READABILITY.									
DISPOSITION CODE		PART NO.		DISPOSITION		STOCK		W.I.P.	
1. INCORPORATE CHANGE		919500585		✓		11# 10+		11# 10+	
2. SCRAP		911800164		✓		3/		3/	
3. USE AS IS		919500513		✓		3/		3/	
CODE X		DATE		CODE Y		DATE		CODE Z	
INGR <u>C.O. Ormer</u>		4/19/83		ENGR				FINANCE	
MFG. ENG		4/22/83		SALES				PRESIDENT	
QA <u>22/83</u>		4/22/83		MKT					
DOC CONTROL <u>1/2</u>		4/22/83		OPER					
CLASSIFICATION CODE		5/3/83		5/3		A		AC	
REF. <u>ICR 83-04</u>						A		AR	
NUMBER						B		D	
18618						NA			
ORIG. BY <u>J. NELSON</u>		DATE		INC. BY <u>K.W. HEAT</u>		CHK. BY		5/23/83	
4-15-83								5/24/83	

REWORK
RETROFIT

SEE ECO
SHEET 6

- ENG- CREATE DRAWING NO. 1 DRAWING
- ON A03274600 SPEC, PANEL METER, CHANGE TO CAL LINE
- ON CO3276000 INSTRUCTION LABEL ADD LOCATION OF CO3502900 INSTRUCTION LABEL SUPPLEMENTARY.

ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

☒ ☐ ☐

NUMBER **187-18**
DATE **4-15-83**
SHEET **2** OF **7**

ON C03502900 INSTRUCTION LABEL SUPPLEMENTARY

ADD FOLLOWING INFORMATION;

00	1	D03275800	413A
ASSY	QTY	NEXT ASSY	MODEL NO
OR			
ITEM			

APPLICATION BLOCK

ADD NOTES;

1. MATERIAL TO BE .008 ± .003 THK ALUMINUM

FOTOFOIL

2. ART WORK TO BE SHEET TWO

3. ART WORK TO BE FURNISHED BY SIERRA.

4. ALL CHARACTERS TO BE LUSTERLESS BLACK, COLOR NO 37038 OF FED-STD-595.

5. BACKGROUND TO BE CLEAR ALUMINUM COLOR

6. NAME PLATE TO BE TRIMMED TO DIMENSIONS SHOWN

7. ADHESIVE BACKING TO BE PRESSURE SENSITIVE WITH PAPER PROTECTION (3M SCOTCH 467 OR SIERRA APPROVED EQUIVALENT)

8. SAMPLE LABEL TO BE SUBMITTED TO SIERRA FOR APPROVAL PRIOR TO PRODUCTION.

• ON A03274600 SPECIFICATION, PANEL METER, ANALOG.
ADD NOTE 7. TO SHEET 6 OF A03274600

NOTES:

7. NOMENCLATURE "CAL" TO BE 10 PT EUROSTYLE
EXTENDED IN RED PANTONE 032C, INCLUDE
RELATED DIAL MARKINGS

• ON A03274600. CONTD CHANGE TO NOTE 1

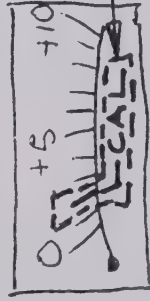
1. ALL DIAL MARKINGS AND NOMENCLATURE TO BE
LUSTERLESS BLACK NO 37038 OF FED-STD-595

WAS

1.) ALL DIAL MARKINGS AND NOMENCLATURE TO BE
LUSTERLESS BLACK NO 37038 OF FED-STD-595
EXCEPT "CAL" AND RELATED LINES, SEE NOTE
7

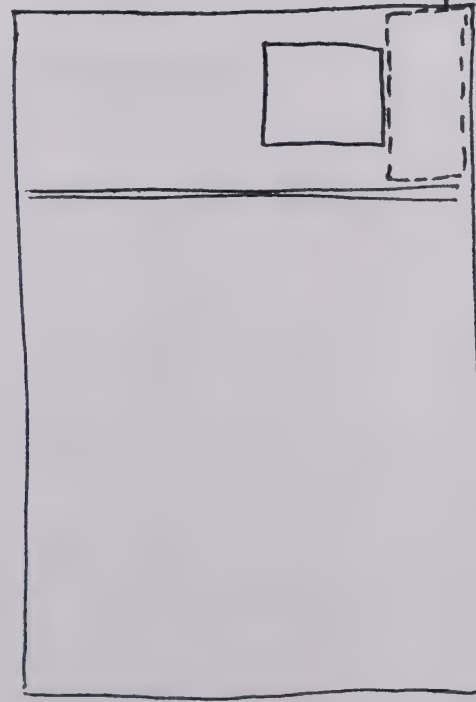
TO BE

• ON A03274600 ADDITION TO FIGURE ONE



SEE NOTE 7

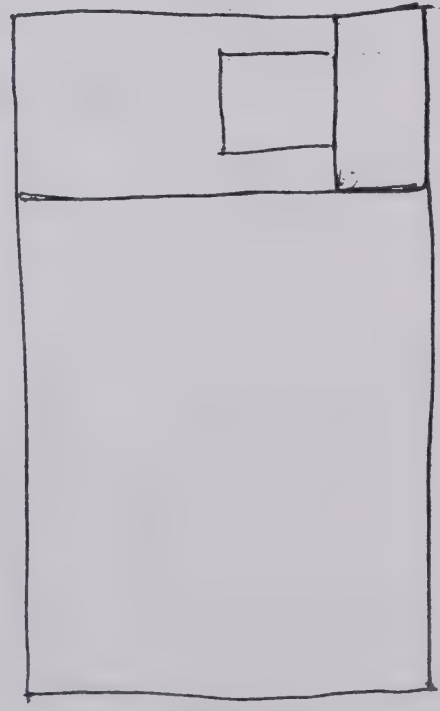
• ON CO3276000 INSTRUCTION LABEL



*** REWORK/RETROFIT
LOCATION**

DASHED AREA TO
SHOW LOCATION OF
CO3502900 INSTRUCTION LABEL
SUPPLEMENTARY.

• ON CO3276000 INSTRUCTION LABEL



ADD TO VISUAL
ADD TO ARTWORK.
FOR NEW LABELS ADD
INFO FROM CO3502900 TO
CO3276000, MAKING THEM
AS ONE.

SCALE	CODE IDENT NO.	SIZE	DRAWING NO.
94668	A	A03274600	6
SHEET	6		

7. NOMENCLATURE

CENTER LINE.

6. TITLE (DB, DBX) TO BE CENTERED ON METER FACE

5. SEE FIGURE 2 FOR SCALE CALIBRATION DETAIL.

4. SIERRA STOCK NO. AND FULL SCALE CURRENT RATING SHALL BE LOCATED APPROXIMATELY WHERE SHOWN.

3. SCALE NUMBERS TO BE 10PT EUROSSTYLE EXTENDED; TITLE LETTERS TO BE 10PT UPPER AND LOWER CASE EUROSSTYLE EXTENDED. ALL OTHER NOMENCLATURE TO BE 6PT EUROSSTYLE EXTENDED.

2. ALL SCALE NUMBERS TO BE CENTERED ABOUT THEIR RESPECTIVE GRADUATIONS.

1. ALL DIAL MARKINGS AND NOMENCLATURE TO BE "LUSTERLESS BLACK NO. 37038 OF FED-STD-595, EXCEPT CAL AND RELATED UNITS SEE NOTE 7

NOTES:

ECO# 18618
Sheet 5 of 6

TOLERANCES TO BE ± 0.02

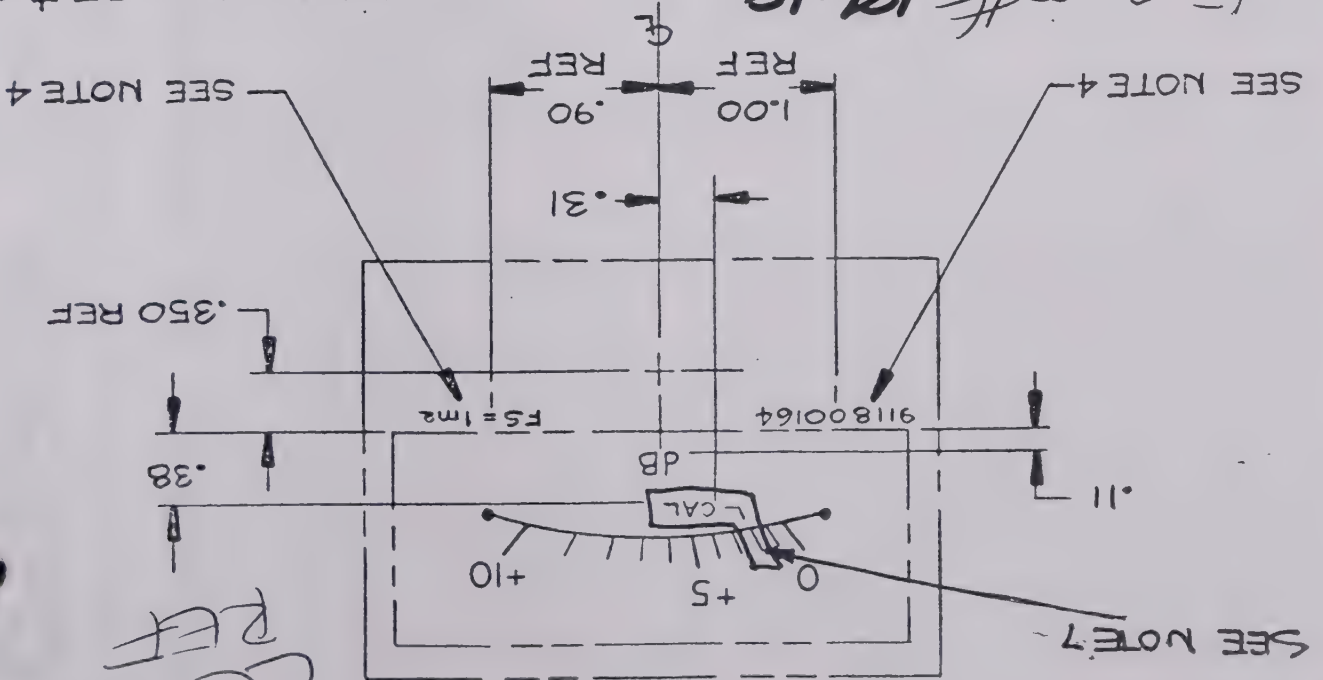


FIGURE 1

ENGINEERING CHANGE ORDER ☐
ENGINEERING VARIANCE ORDER ☐
TYPE 1 CHANGE ORDER ☐

NUMBER 18-118
DATE 4-15-83
SHEET 6 OF 7

• REWORK INSTRUCTIONS:

Production
(FINAL ASSY)

— INSTALL SUPPLEMENTARY LABEL
919500585 TO INSTRUCTION LABEL
AS SHOWN ON SHEET 4 OF E.C.O.
UNTIL NEW INSTRUCTION LABELS
ARE AVAILABLE

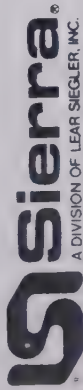
Customer
Repair

— Add SUPPLEMENTARY LABEL to
ALL 413A'S RETURNED FOR
REPAIR AS NEEDED.

When using the WECO Adapter type
ED 3C583-30.G1 (326A), set the
BRDG/TERM switch as follows:
413A Sending - Set to BRDG
413A Receiving - Set to TERM.

LABEL INFORMATION SUPPLEMENTARY
413A C03502900 REV A.

ECO
12/1/82
Sheet 7



ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

NUMBER 19332
DATE Aug 17 1984
SHEET 1 OF 2

EFFECTIVITY		JOBS		MODELS		AFFECTED DOCUMENT		AFFECTED DOCUMENT		CHANGE REV.	
MODEL	S/N OR DATE	AFFECTED	AFFECTED	MODEL	AFFECTED	DOCUMENT NUMBER	DESCRIPTION	DOCUMENT NUMBER	DESCRIPTION	FROM	TO
413A	101EUP	J946EUP	413A			D03276400	FRONT PANEL ASSY			F	G
413A-11	101AUP	NEXT	413A-11			D03359400	FRONT PANEL ASSY			D	E
						D03539900	FRONT PANEL ASSY			B	C
						D03541800	FRONT PANEL ASSY			B	C
						D03267000	INTERCONNECT DIAGRAM			E	F
						D03340100	INTERCONNECT DIAGRAM			E	F

A. SUMMARY MFG. COST OF CHANGE \$ 150
B. EXPECTED MLB CHANGE ☐ HIGHER ☐ LOWER
\$ 0

- AFFECTED YES NO
- C. PERFORMANCE ☐ ☒
- D. APPEARANCE ☐ ☒
- E. INTERCHANGEABILITY ☐ ☒
- F. SCHEDULE ☐ ☒
- G. JOBS ☐ ☒
- H. BOM ☐ ☒
- J. TOOLING ☐ ☒
- K. VISUAL AIDS ☐ ☒
- L. OPERATION SHEET ☐ ☒
- M. TEST PROCEDURE ☐ ☒
- N. MANUAL ☐ ☒
- P. PUBLISHED DATA ☐ ☒
- R. 3060 ☒

ON ALL ABOVE DWGS CHANGE WIRE ROUTING TABLE & VIEWS. AS SHOWN PER EXAMPLE ON SHT. 2. (REVERSING WIRING TO J4 ON FRT PANEL.)

* REWORK INSTRUCTIONS- PURGE ALL 413A UNITS IN FINISHED GOODS AND REVERSE WIRING (GRN & WHT WIRE) GOING TO J4 (AC CONNECTOR) ON FRT. PANEL.

*X - CUST. SERV. - REVERSE GRN & WHT WIRES TO J4 AS UNITS ARE RETURNED FOR REPAIR.

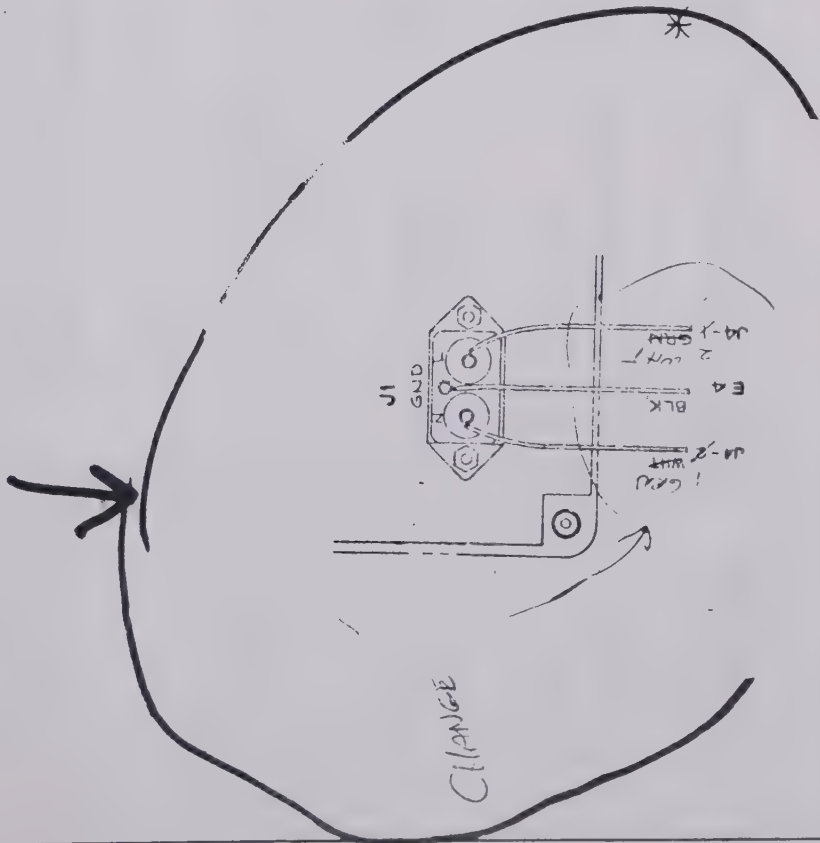
*FIELD RETROFIT REQUIRED YES ☐ NO ☐ PLM ☐ , S/N ☐ , TO ☐

REASON FOR CHANGE: FUSE WAS CONNECTED TO NEUTRAL LEAD OF AC CONNECTOR. S/B TO HOT LEAD. SEE CAR # 359

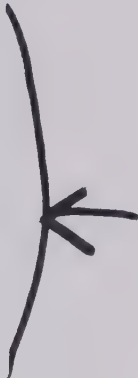
DISPOSITION CODE		PART NO.	DISPOSITION	STOCK	W.I.P.	TEST	COMPLETE	ON ORDER	CUST SERV
1. INCORPORATE CHANGE		AO 3276300	✓	1/ *	1/ * 25	1/ * 50	3/ * 75	1/ -	1/ * *
2. SCRAP		AO 3359300	COST	1/ -	1/ -	1/ -	3/ -	1/ -	1/ * *
3. USE AS IS									
CODE X		DATE	CODE Y	DATE	CODE Z	DATE	ORIG. BY	INC. BY	CHK. BY
ENGR		8/17/84	ENGR	8/21/84	FINANCE		Wht Koon	Pete D. Bagnore	11-13-84
MFG. ENG		8/21/84	SALES		PRESIDENT				
QA		8/21/84	MKT		CLASSIFICATION CODE	A AC AR B D NA			
OPER		8/21/84	OPER	8/27/84	REF. CAR # 359				
NUMBER									19332

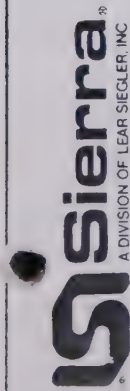
D03276400, D03359400, D03539900 & D03541800

WIPE ROUTING					
USE WIRE ITEM	WIRE NO.	COLOR	FROM	REMARKS	TO
3		ORN/BLK	A6/P7-23		36-6
1		ORN/WHT	A6/P7-24		R4-2
3		WHT/BLU	J3-H	DATA-1	33-3
25		BLU	J3-J	DATA-2	33-6
3		WHT/GRN	J3-L	DATA-3	33-9
		GRN	J3-N	DATA-4	33-12
		BLK	J2-S	DATA-5	E4
		BLK	J1-GND	DATA-6	E4
		BLK	P1-1	DATA-7	E4
		RED	P1-2	DATA-8	E4
3		WHT/ORN	SG-5	DATA-9	E2
474	2	GRN	J1-KN	DATA-10	44-1
484	3	WHT	J1-M1	DATA-11	44-2



CHANGE





ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

AUTO INSERT AFFECTED ☒ Y ☐ N

NUMBER 2009
DATE 7-22-86
SHEET 1 OF 1

EFFECTIVITY		JOBS AFFECTED		MODELS AFFECTED		AFFECTED DOCUMENT		CHANGE REV.	
MODEL	S/N OR DATE					DOCUMENT NUMBER	DESCRIPTION	FROM	TO
413A	7-22-86	J153		413A		D03541200 ✓	Unit Assy	E	F
415A2	7-22-86	J154		415A2		D03553900 ✓	Unit Assy	A	B
415A4	7-22-86	J136		415A4		D03553000 ✓	Unit Assy	A	B
315B	7-22-86	Next		315B		D03587000 ✓	Unit Assy	A	B
A. SUMMARY MFG. COST									
OF CHANGE \$ _____									
B. EXPECTED MLB CHANGE									
☐ HIGHER									
☒ LOWER									
\$ _____									

AFFECTED YES NO

- C. PERFORMANCE ☐ ☒
- D. APPEARANCE ☐ ☒
- E. INTERCHANGEABILITY ☐ ☒
- F. SCHEDULE ☐ ☒
- G. JOBS ☐ ☒
- H. BOM ☐ ☒
- J. TOOLING ☐ ☒
- K. VISUAL AIDS ☐ ☒
- L. OPERATION SHEET ☐ ☒
- M. TEST PROCEDURE ☐ ☒
- N. MANUAL ☐ ☒
- P. PUBLISHED DATA ☐ ☒
- R. 3060 ☐ ☒

Change on all above documents

Delete 917300526 14 in

Add 4324-1003 7 in 1/2" Foam

Cust Service

As units are returned for repair, incorporate this change.

*FIELD RETROFIT REQUIRED YES ☒, NO ☐, PLM _____, EST. COST _____, S/N _____, TO _____

REASON FOR CHANGE: DIFFICULT TO REMOVE UNIT FROM CASE

QA Request

DISPOSITION CODE	PART NO.	DISPOSITION	STOCK	W.I.P.	TEST	COMPLETE	ON ORDER	CUST SERV
1. INCORPORATE CHANGE	See above	✓	1/NA	1/	NA	3/	1/	1/
2. SCRAP	Document	COST	1/	1/	1/	1/	1/	1/
3. USE AS IS	Block		1/	1/	1/	1/	1/	1/
CODE X	DATE	CODE Y	DATE	CODE Z	DATE	ORIG. BY	INC. BY	7-22-86
ENGR <i>C. Orme</i>	7/24/86	ENGR <i>Drimmer</i>	7/24/86	FINANCE		J. Lillie	<i>R. Puer</i>	8-1-86
MFG. ENG	7/24/86	SALES		PRESIDENT			<i>C. Moore</i>	8-20-86
QA <i>J. Lillie</i>	7/25/86	MKT		CLASSIFICATION CODE	A AC AR B D NA		NUMBER	
DOC <i>Reggie Coen</i>	7/25/86	OPER <i>William</i>	7/25/86	REF.			20099	

REVISIONS

SYM	DESCRIPTION	DATE	APPROVED
A	PRODUCTION RELEASE PER ECO 20513	12-11-78 BC 6-13-88	<i>[Signature]</i> CM

FOR REFERENCE USE ONLY

AUG 26 1991

			 Sierra		CODE IDENT. NO.	
			LEAR SIEGLER, INC. SIERRA ELECTRONIC DIVISION MENLO PARK, CALIFORNIA 94025		54778	
			PRODUCTION TEST PROCEDURE FOR 413A PCM Cable Test Set			
			DATE 2-27-78	SIZE A	DRAWING NO. A03307900	REV B
			BY <i>Rolf Rejbrand</i>			
			APPROVED <i>[Signature]</i>			
NEXT ASSY.	QTY	MODEL NO. 413A	STOCK AS			SHEET 1 OF 17

TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
1.0	SCOPE	3
2.0	APPLICABLE DOCUMENTS	3
3.0	EQUIPMENT REQUIRED	3
4.0	PRELIMINARY ALIGNMENT	4 - 7
5.0	HEAT RUN	8
6.0	FINAL ALIGNMENT	8 - 13
7.0	PRODUCT ACCEPTANCE TEST	14 - 16
8.0	FIGURE DIAGRAM, TEST EQUIPMENT INTERCONNECT	17

 Sierra	SIZE	DRAWING NO.	
	A	A03307900	
CODE IDENT NO. 54778	SCALE	SHEET 2 OF 17	

- 1.0 SCOPE
- 1.1 This procedure provides information to perform production alignment and unit acceptance testing of 413A PCM Cable Test Set.
- 1.2 This procedure requires that all subassemblies have been pretested and preliminary aligned.

2.0 APPLICABLE DOCUMENTS

2.1 Drawings

413A Interconnection Schematic D03221700

413A Block Diagram C03177800

413A Maintenance Manual

2.2 Test Report

The Test Report used for recording section 7.0 Product Acceptance Test is Production Test Report A03308000.

3.0 TEST EQUIPMENT REQUIRED

<u>Qty.</u>	<u>Description</u>	<u>Recommended</u>
1	Digital Multimeter	Fluke 8000A
1	Oscilloscope	TEK R7603
1	Oscilloscope Plug-In	7A18
1	Oscilloscope Timebase	7B50
1	Frequency Counter	HP5302A
1	Power Supply	HP6205B
1	RMS Voltmeter	HP3400A
1	PCM Test Generator	TF00091-2
1	Power Panel	D03079700
1	Interface Panel	TF00133

 Sierra CODE IDENT NO. 54778	SIZE A	DRAWING NO. A03307900
	SCALE	SHEET 3 OF 17

4.0 PRELIMINARY ALIGNMENT

4.1 Visual Inspection

Visually inspect all circuit cards and wiring connection for possible shorts, broken or disconnected leads, pinched wires/cables, solder splashes, and/or any other abnormal condition which could affect the 413A performance.

4.2 Equipment Warm-Up

Turn on the Test Station and allow all test equipment a 5 minute warm-up.

4.3 Initial Set-Up

4.3.1 Adjust test station power source to 115V AC. (DO NOT connect to 413A U.U.T. at this time.)

4.3.2 Connect probe from 413A INTERFACE PANEL to 413A U.U.T. probe connector.

4.3.3 Connect BATT. OUT on INTERFACE PANEL to 413A U.U.T. battery plug.

4.3.4 The following switches will be in positions as shown throughout the entire test.

PCM GEN.:	POWER	-	ON
	MOD	-	OFF
	FUNCTION	-	AMI
	DISABLE AFTERKICK	-	ON
	PULSE PERIOD	-	N/A

INTERFACE:	TERM	-	100
	PCM GEN.	-	100

4.3.5 Perform the tests per Table 4.4 in the given sequency. Only changes to setup are given. If testing is resumed after repair or trouble shooting return to top of page for initial set-up for that page and make the required changes in sequency to restart point.

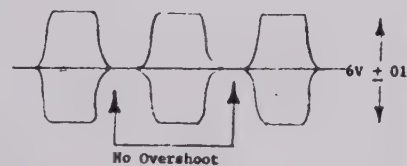
 Sierra	SIZE	DRAWING NO.	
	A	A03307900	
CODE IDENT NO.	SCALE	SHEET 4 OF 17	
54778			

2

[illegible]

TABLE 4.4 413A PRELIMINARY ALIGNMENT

413A UNDER TEST							OUTPUT REQUIREMENTS				COMMENTS
GENERAL TALK	DIRECTION	FUNCTION	METER	CABLES	SYSTEM	CAL	POINT	WITH	REQUIRED VALUE	ADJUST IF NECESSARY	
N/A	UNI	CAL	Loss	20	T1	N/A		DC Power Supply	500MA		
							TP1-A1	DMM	10.0-10.1V	R22-A1	
							See Comm.	DMM	5.0 $\pm$.2V		Measure between gnd. and pin closest to front panel on voltage regulator LM340 on Power Supply Panel.
							BATT. LOW Lamp	U.U.T.	Lamp Flashing	R15-A1	If not, R15-A1 should be readjusted per A1-subassembly test procedure T03263100.
							TP1-A1	DMM	See Comments	N/A	DMM $\leq$ 0.5V BATT. LOW Lamp on solid.
							BATT. LOW Lamp	U.U.T.	Lamp OFF		
		CHC					BATT. OUT (Interface Panel)	DMM	16 $\pm$ 1V		Connect AC Power to 413A.
		Send B					Panel Monitor	Scope	6.0 $\pm$ 0.1V	R9-A2	Connect Scope to MONITOR
					T1C					N/A	
		B1			T1						
		Send A									
		UNI									

Cuty Cycle 50 $\pm$ 5%

8

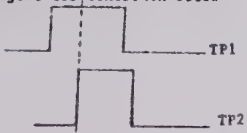
7

6

5

PCM GENERATOR					INTERFACE PANEL			
ITEM	TEST	NOISE	XMIT	SYSTEM	ARTLINE	DIRECTION	FUNCTION	EA
3	ALBO	OFF	Norm	T1	43	UNI	Send A	CH
					T1C	40		
4	Error Detector Sampling Time				T1			
					T1C			
5	Meter Circuit				T1	24		
					T1C	24		
					T1			

NOTE: *Add: A. Remove the 310 patchcor
 B. Verify the 413A PULSE 1
 C. Remove the 310 patchcor

413A UNDER TEST							OUTPUT REQUIREMENTS				COMMENTS
GENERATOR	DIRECTION	FUNCTION	METER	CABLE LOSS	SYSTEM	CAL	POINT	WITH	REQUIRED VALUE	ADJUST IF NECESSARY	
N/A	UNI	NCV A	LOSS	20	T1	N/A	TP1-A4	SCOPE	See Comments	R56-A4	Adjust so that eye-ampl. just reaches max. 
					TLC					R54-A4	Adjust for max. eye-opening & ampl. 
					T1		TP1 & TP2-A3	SCOPE	See Comments	R21-A3	Adjust for condition below 
					TLC					R2D-A3	Verify PULSES lamp ON ERRORS lamp OFF
					T1	See Comm.	U.U.T. Meter	U.U.T.			Calibrate as follows: 1) Set CABLE LOSS attenuator to 20. 2) Set LOSS CAL pot for a 0 dB reading on 413A meter. 3) Set CABLE LOSS attenuator to 10. 4) Adjust pot R38 on A3-board for a meter reading of 10. 5) Repeat steps 1) - 4) until meter reads exactly 0 and 10 for the two positions of CABLE LOSS attenuator. 6) Adjust R38 for a meter reading of 24.0 dB. 7) Step AIRLINE switch through positions 5-40 and verify that 413A meter readings are within ± 1 dB of calibrated readings posted on PCM Test Generator.
				30	TLC						* 1) Adjust R37 on A3-board for a meter reading of 34.1. 2) Step AIRLINE through all positions and verify 413A meter reading within ± 1dB of reading posted on PCM GENERATOR for positions 5-36 and within ± 2dB for positions 38 and 40. *
		CAL		30					U.U.T. Meter Reading of 32dB	A7-R64	
										A7-R66	

1 from the PCM GEN LIN SIM OUT, and connect to the PCM GEN. PULSE GEN OUT.
 amp is ON, ERRORS lamp is OFF, and the meter reads 0 dB +/- 1.
 1 from the PCM GEN. PULSE GEN OUT, and connect to the PCM GEN. LINE SIM OUT.

THIS DRAWING AND SPECIFICATIONS SHALL NOT BE COPIED OR USED WITHOUT WRITTEN CONSENT OF LEAH SEGGER, INC., SIERRA ELECTRONIC DIVISION.

413A UNDER TEST							OUTPUT REQUIREMENTS				COMMENTS
DETECTION	FUNCTION	METER	CABLE	LOSSES	SYSTEM	GAL	POINT	WITH	REQUIRED VALUE	ADJUST IF NECESSARY	
N/A	UNI	RCV A	LOSS	20	T1	Calibrated	413A Meter		24.1 ± .2		PULSES lamp shall be ON ERRORS lamp shall be OFF
	BI										
		RCV B									
	UNI										
Fully CW		CAL	X-Talk			N/A	413A Meter	U.U.T.		R51-A5	1) Adjust for 0 on 413A meter. 2) Turn X-Talk Gen. and verify that full scale reading can be reached.
Adj. for Sds on meter							Error Lamp	U.U.T.		R6-A7	Adjust for a flashing rate of about 1 flash per second.
					T1C					7	

- 5.0 BURN-IN
- 5.1 Disconnect instrument from Test Station and move to burn-in racks.
- 5.2 Connect U.U.T. to burn-in rack as required by Quality Control Instructions No. 45.
- 5.3 On U.U.T. Set Switches:
- FUNCTION to CAL
- METER to X-TALK
- 5.4 Adjust X-TALK GENERATOR control so that the ERROR lamp flashes at a rate of about one flash per second. (Shall be for a reading of 8 ± 1 dB on meter.)
- 5.5 After 24 hours burn-in, set X-TALK GENERATOR so that the ERROR lamp flashes at a rate of about one flash per second. The U.U.T. meter shall read 6-10 dB. If a drift has taken place so that the flashing does not occur within this range, it is necessary to replace transistor Q2 (910303904) on board A7 and recalibrate noise source per A7 SubAssembly Test Procedure T03265500 paragraph 4.4 before burn-in is continued.
- 5.6 Upon completion of burn-in requirements, remove U.U.T. and return to Test Station area.
- 6.0 FINAL ALIGNMENT
- 6.1 Adjust Test Station Power Source to 115V AC. (DO NOT connect to 413A U.U.T. at this time.)
- 6.2 Connect probe from 413A INTERFACE PANEL to 413A U.U.T. probe connector.
- 6.3 Connect BATT. OUT on INTERFACE PANEL to 413A U.U.T. battery plug.
- 6.4 Perform Final Alignment per Table 6.5.

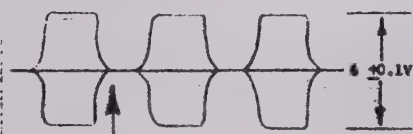
 Sierra	SIZE	DRAWING NO.	
	A	A03307900	
CODE IDENT NO.	SCALE		
54778	SHEET 8 OF 17		

[illegible]

413A UNDER TEST

OUTPUT REQUIREMENTS

TEST

GENERATOR TALK	FUNCTION	METER	CABLES	SYSTEM	CAL	POINT	WITH	REQUIRED VALUE	ADJUST IF NECESSARY	COMMENTS
N/A	UNIT	CAL	Loss	20	T1	N/A	DC POWER SUPPLY	500MA		
						TP1-A1	DMH	10.0 - 10.1V	R22-A1	
						See Comm.	DMH	5.0 $\pm$.02V		Measure from gnd. to pin closest to front panel on IC voltage regulator LM340 on Power Supply Panel.
						BATT LOW Lamp	U.U.T.	Lamp Flashing	R15-A1	
						TP1-A1	DMH	See Comm.		DMH $\angle$ 0.5V BATT. LOW Lamp on solid.
						BATT LOW Lamp	U.U.T.	BATT LOW Lamp OFF		
	CHG					BATT OUT Interface Panel	DMH	16 $\pm$ 1V		Connect AC Power to U.U.T.
	Send A									1) Disconnect Probe Connector 2) Terminate U.U.T. with 105Ω to SEND/RCV 310 jack. 3) Connect SCOPE in ADD-mode across termination.  4) Remove scope & connect RMS voltmeter across termination. 5) Fine adjust R9 for -4.5dB using +10dB range on dB-meter.
					TIC					dB-meter reading shall change $\leq$ 0.2dB.

6.0 FINAL ALIGNMENT (continued)

6.6 Test On Cable

6.6.1 The remaining part of the Final Alignment HAS TO BE PERFORMED ON THE CABLE in the Engineering Lab.

Use one unit of 413A that has passed step 2 of this Final Alignment Procedure as a transmitter. This unit will be referred to as TRANSMIT UNIT.

6.6.2 Set-Up

6.6.2.1 Connect 310 jack SEND/RCV of 413A TRANSMIT UNIT to 11035 ft. length INPUT jack of PIC cable test panel.

6.6.2.2 Set TRANSMIT UNIT Function switch to SEND A.

6.6.2.3 Connect 310 jack SEND/RCV of 413A U.U.T. to OUTPUT 11035 ft. length jack of PIC cable test panel.

6.6.2.4 On 413A U.U.T. set Function switch to RCV A.

BRDG/TERM	TERM
METER	LOSS

6.6.3 T1 Eye Adjustment

6.6.3.1 Set System switch on both TRANSMIT UNIT & U.U.T. to T1.

6.6.3.2 Connect scope to TP1 of A4.

6.6.3.3 Adjust R56 on A4 so that the eye amplitude just reaches maximum level. Eye amplitude shall be $2 \pm 0.2V$.

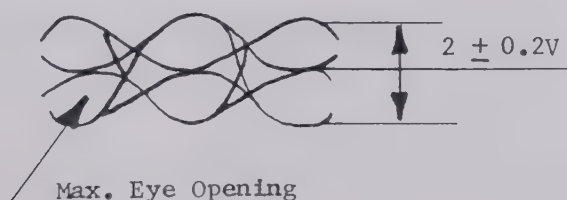
6.6.4 T1C Eye Adjustment

6.6.4.1 Set System switch on both TRANSMIT UNIT & U.U.T. to T1C.

6.6.4.2 Connect TRANSMIT UNIT SEND/RCV jack to 7205 ft. length INPUT jack of PAPER cable test panel.

6.6.4.3 Connect U.U.T. SEND/RCV jack to 7205 ft. length OUTPUT jack of PAPER cable test panel.

6.6.4.4 Adjust R54 on A4 for max. eye opening and max. amplitude.



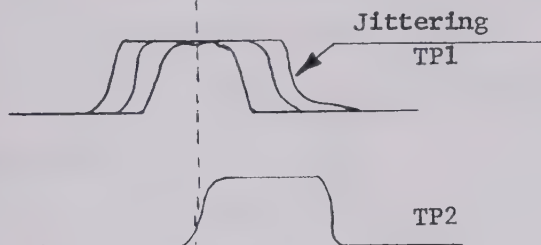
 Sierra	SIZE	DRAWING NO.	
	A	A03307900	
CODE IDENT NO.	SCALE	SHEET 10 OF 17	
54778			

6.0 FINAL ALIGNMENT (continued)

6.6.5 Error Detector Sampling Time

6.6.5.1 Connect scope channel 1 to A3-TP1 and channel 2 to A3-TP2.
Trigger off channel 2.

6.6.5.2 Adjust R19 for condition shown below:



ERRORS lamp shall be OFF and PULSES lamp shall be ON when adjustment is correct.

6.6.5.3 Set SYSTEM switch on both TRANSMIT UNIT and U.U.T. to T1.

6.6.5.4 Repeat 6.6.5.2 adjusting R18 instead.

6.6.6 Loss Calibration

6.6.6.1 Connect TRANSMIT UNIT to INPUT jack & U.U.T. to OUTPUT jack of PAPER CABLE; length 4114 ft on the PAPER cable test panel.

6.6.6.2 On U.U.T. set: CABLE LOSS attenuator to 10. Function switch to RCV A.

6.6.6.3 Adjust R38 on A3, for a meter reading of 10.

6.6.6.4 Switch CABLE LOSS to 20. Adjust CAL (LOSS) for a meter reading of 0.

6.6.6.5 Repeat 6.6.6.3 & 6.6.6.4 until meter reads exactly 10 & 0 for the two positions of CABLE LOSS switch.

6.6.6.6 Adjust R38 for a meter reading of 21.6 dB.

NOTE: DO NOT TOUCH CAL (LOSS) UNTIL LOSS CALIBRATION IS COMPLETED.

6.6.6.7 Set System switch on both TRANSMIT UNIT & U.U.T. to T1C.

 Sierra	SIZE	DRAWING NO.	
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CODE IDENT NO.	SCALE	SHEET 11 OF 17	
54778			

- 6.0 FINAL ALIGNMENT (continued)
- 6.6.6 Loss Calibration (continued)
- 6.6.6.8 Set U.U.T. CABLE LOSS attenuator to 30.
- 6.6.6.9 Adjust R37 on A3 for a meter reading of 32.8dB.
- 6.6.6.10 Set U.U.T. Function switch to CAL.
- 6.6.6.11 Adjust R64 on A7 for a meter reading of 32.0dB.
- 6.6.6.12 Set System switch on U.U.T. to T1.
- 6.6.6.13 Adjust R66 on A7 for a meter reading of 32.0dB.
- 6.6.6.14 Set U.U.T. Function switch to RCV A.
- 6.6.6.15 For each length of PAPER CABLE check U.U.T. meter reading.
Verify that all readings are within ± 1 dB of reading posted on test panel.
- 6.6.6.16 Set System switch on both units to T1C.
- 6.6.6.17 Check U.U.T. meter reading for each length of PAPER CABLE.
Verify that readings are within ± 1 dB for lengths 1030-6479
and within ± 2 dB for position 7205. (7205 is outside the range
of 413A.)
- 6.6.6.18 Move patch cords from the PAPER cable test panel to PIC cable test panel.
- 6.6.6.19 For each length of PIC CABLE check U.U.T. meter reading.
Verify that readings are within ± 1 dB for lengths 1942-8992 and
within ± 2 dB for 9988.
- 6.6.6.20 Set System switch on both units to T1.
- 6.6.6.21 For each length of PIC CABLE check U.U.T. meter reading.
Verify that the readings are within ± 1 dB. (11035 is outside the
range of 413A.)

 Sierra	SIZE	DRAWING NO.	
	A	A03307900	
CODE IDENT NO.	SCALE		
54778	SHEET 12 OF 17		

- 6.0 FINAL ALIGNMENT (continued)
- 6.6.7 X-Talk
- 6.6.7.1 Set U.U.T. Function switch to CAL, System switch to T1, and Meter switch to X-Talk.
- 6.6.7.2 Turn X-Talk Generator fully CCW. Adjust R51 on A5 for 0 reading on U.U.T. meter.
- 6.6.7.3 Turn X-Talk Generator fully CW and verify that full scale can be reached.
- 6.6.7.4 Turn X-Talk Generator for a reading of 8dB.
- 6.6.7.5 Adjust R6-A7 for an ERRORS flashing rate of about 1 flash per second.
- 6.6.7.6 Turn System switch to T1C.
- 6.6.7.7 Adjust R14 on A7 for an ERRORS flashing rate of about 1 flash per second.
- 6.6.8 Brdg./Term.
- 6.6.8.1 Set System switch on both units to T1.
- 6.6.8.2 Set U.U.T. Function switch to RCV A.⁴
- 6.6.8.3 Select PIC CABLE length 7019. Note U.U.T. reading.
- 6.6.8.4 Set U.U.T. Term./Brdg. switch to BRDG.
- 6.6.8.5 Meter reading shall be within $\pm .2$ dB of reading in step 6.6.8.3. Use a patch cord terminated with 105 ohm, 1%, to connect to the U.U.T.

 Sierra	SIZE	DRAWING NO.
	A	A03307900
CODE IDENT NO.	SCALE	SHEET 13 OF 17
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- 7.0 PRODUCT ACCEPTANCE TEST
- 7.1 Product Acceptance Test shall be performed at 413A Test Station.
- 7.2 This section is a "hands-off" performance tests. It is to be performed after the instrument has been thoroughly aligned per section 6.0, final internal inspection completed, and the unit is in it's case.
- 7.3 Performance shall be recorded per Production Test Report A03308000 if so requested.
- 7.4 Any measurements which fail and require readjustment and/or repair will constitute the failure of the instrument and void any acceptance data and the U.U.T. will be returned to final alignment operation (section 6.0.)
- 7.5 Set-Up
- 7.5.1 Adjust TEST STATION POWER SOURCE to 115V AC and connect 413A U.U.T.
- 7.5.2 Connect probe from 413A INTERFACE PANEL to U.U.T. probe connector.
- 7.6 Test of Loss Measurement
- 7.6.1 On PCM Test Generator Set:
- | | |
|--------------------|------|
| POWER to | ON |
| NOISE SIM. | OFF |
| XMIT | NORM |
| MOD. | OFF |
| FUNCTION | AMI |
| DISABLE AFTER KICK | ON |
| SYSTEM | T1 |
- 7.6.2 On Interface Panel set:
- | | |
|-----------|--------|
| TERM to | 100 |
| PCM GEN. | 100 |
| DIRECTION | UNI |
| FUNCTION | SEND A |
- 7.6.3 On 413A U.U.T.[†] set:
- | | |
|-------------|---------|
| FUNCTION to | CAL |
| SYSTEM | T1 |
| METER | LOSS |
| CABLE LOSS | 30 |
| RCV | TERM |
| RPTR TYPE | UNI-DIR |

 Sierra CODE IDENT NO. 54778	SIZE A	DRAWING NO. A03307900
	SCALE	SHEET 14 OF 17

- 7.0 PRODUCT ACCEPTANCE TEST (continued)
- 7.6 Test of Loss Measurement (continued)
- 7.6.4 Turn CAL pot. for a U.U.T. meter reading of 32 dB.
- 7.6.5 Turn Function switch to RCV A.
- 7.6.6 Remove the 310 patchcord from the PCM GEN. LINE SIM OUT, and connect to the PCM GEN. PULSE GEN OUT.
- 7.6.7 Verify the 413A PULSE lamp is ON, ERRORS lamp is OFF, and the meter reads 0 dB +/- 1.
- 7.6.8 Remove the 310 patchcord from the PCM GEN. PULSE GEN OUT, and connect to the PCM GEN. LINE SIM OUT.
- 7.6.9 Step ART LINE switch on PCM GENERATOR thru positions 5-40. Verify that readings are within +/- 1 dB of calibrated readings posted on TEST STATION. In all positions PULSES lamp shall be ON and ERRORS lamp shall be OFF.
- 7.6.10 Set XMIT switch on PCM GENERATOR to XMIT ERRORS. U.U.T. ERRORS lamp shall flash indicating errors.
- 7.6.11 On PCM GENERATOR set:
- XMIT to NORM
- SYSTEM to T1C
- 7.6.12 On U.U.T. set System switch to T1C.
- 7.6.13 Step ART LINE switch on PCM GENERATOR thru positions 5-40. Verify a reading within +/- 1 dB for positions 5-36 and +/- 2 dB for positions 38 and 40. In ALL positions PULSES LAMP shall be ON and ERRORS lamp OFF.
- 7.6.14 Set XMIT on PULSE GENERATOR to XMIT ERRORS. U.U.T. ERRORS lamp shall flash.
- 7.7 Xmit Output
- 7.7.1 Set U.U.T. Function switch to SEND B.
- 7.7.2 Remove connection to 413A probe connector.
- 7.7.3 Terminate SEND/RCV output (310 jack) of U.U.T. with 105 Ohm.
- 7.7.4 Connect HP3400 dB meter across the 105 Ohm. The dB meter shall read -4.5 +/- 0.3 dB using +10 dB range.
- 7.7.5 Set U.U.T. System switch to T1. The dB meter reading shall be -4.5 +/- 0.2 dB using +10 dB range.

 Sierra A DIVISION OF LEAR SILEX INC.	SIZE	DRAWING NO.
	A	A03307900
CODE IDENT NO.	SCALE	SHEET 15 OF 17
54778		

7.0 PRODUCT ACCEPTANCE TEST (continued)

7.8 X-Talk

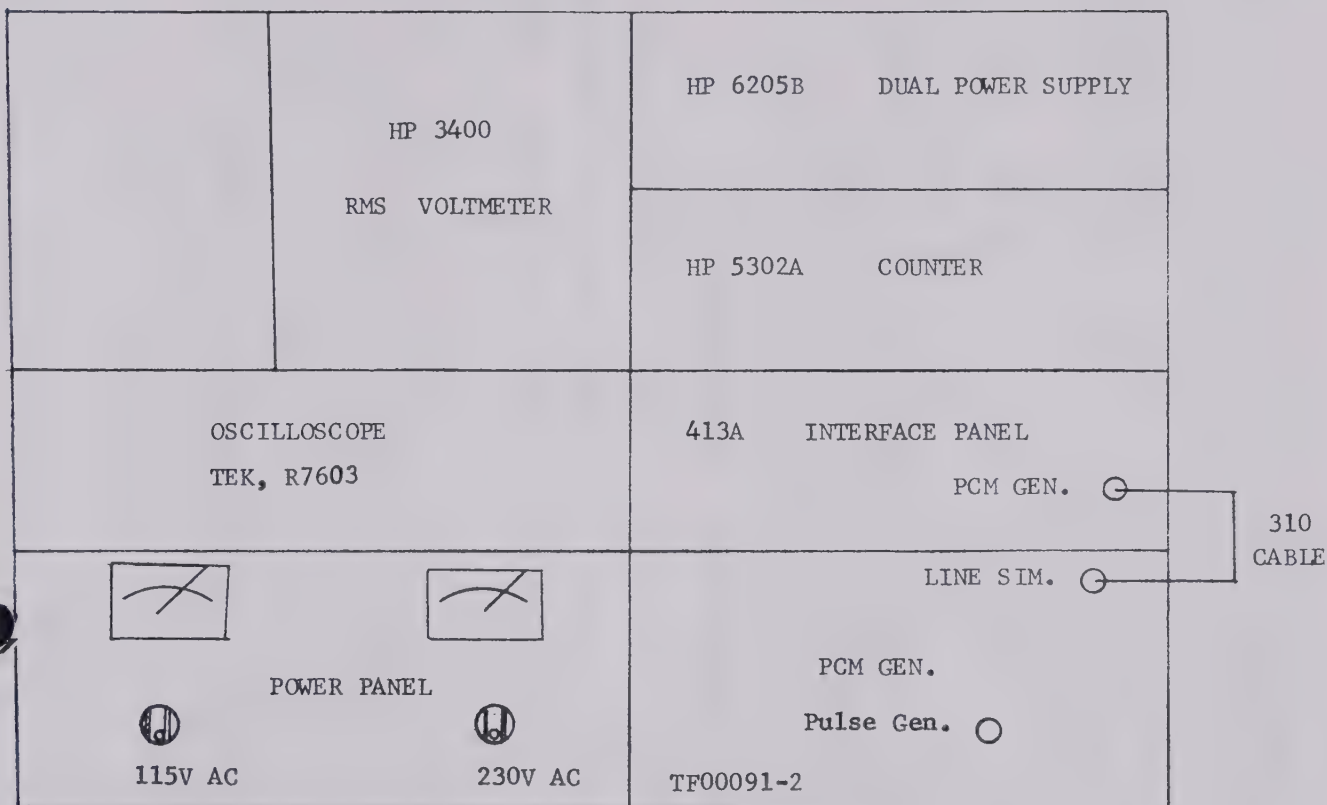
7.8.1 On U.U.T. set:

FUNCTION switch to CAL
METER switch to X-TALK
SYSTEM switch to T1

7.8.2 Turn X-Talk GENERATOR and verify that ERRORS lamp flashes at a rate of approximately one flash per second for a meter reading of 8 ± 1 dB. PULSES lamp shall be ON.

7.8.3 Set System switch to T1C and repeat 7.8.2.

 Sierra	SIZE	DRAWING NO.
	A	A03307900
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TEST EQUIPMENT INTERCONNECT

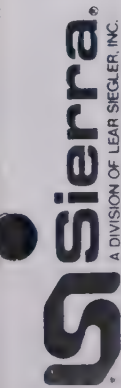
FIGURE 8.0

ENGINEERING CHANGE ORDER

ENGINEERING VARIANCE ORDER

TYPE 1 CHANGE ORDER

NUMBER 20839
DATE 2/21/89
SHEET 1 OF 4



EFFECTIVITY		JOBS AFFECTED		MODELS AFFECTED		AFFECTED DOCUMENT		CHANGE REV.									
MODEL	S/N OR DATE			DOCUMENT NUMBER	DESCRIPTION	FROM	TO										
413A	33854UP	54681	413A	A03265400	A7A PWB ASSY L/M	NI	P										
413A-11	34314UP	C955	413A-11	DO3266800	A7A PWB ASSY SCHEMATIC	F	G										
A. SUMMARY MFG. COST OF CHANGE \$																	
B. EXPECTED MLB CHANGE																	
☐ HIGHER																	
☐ LOWER																	
C. PERFORMANCE																	
D. APPEARANCE																	
E. INTERCHANGEABILITY																	
F. SCHEDULE																	
G. JOBS																	
H. BOM																	
J. TOOLING																	
K. VISUAL AIDS																	
L. OPERATION SHEET																	
M. TEST PROCEDURE																	
N. MANUAL																	
P. PUBLISHED DATA																	
R. 3060																	
DISPOSITION CODE		PART NO.		DISPOSITION		STOCK		W.I.P.		TEST		COMPLETE		ON ORDER		CUST SERV	
1. INCORPORATE CHANGE		A03265400		✓		3		1		1		3		1		/ *	
2. SCRAP																	
3. USE AS IS																	
ENGR		DATE		ENGR		DATE		FINANCE		DATE		ORIG. BY		2/21/89			
MFG. ENG		2/27/89		SALES		2/27/89		PRESIDENT				INC. BY		3-288			
QA		2/27/89		MKT		2/27/89		CLASSIFICATION CODE		A AC AR B D NA		CHK. BY		NUMBER			
DOC CONTROL		2/27/89		OPER		2/27/89		REF. CA 494 495						20839			

1. CHANGE R13 FROM 1K TO 750 OHM (907307500) FOR 413A & 413A-11

2. CHANGE R65 FROM 750 OHM TO 150 OHM (907307500) FOR 413A-11

NOTE: CHANGE TABLE B OF SCHEMATIC AS WELL AS AT COMPONENT DESIGNATORS.

* CUSTOMER SERVICE MAKE CHANGE IF NECESSARY

* FIELD RETROFIT REQUIRED YES ☐ NO ☐ , PLM ☐ , EST. COST ☐ , S/N ☐ , TO ☐

REASON FOR CHANGE:
CHANGE 1. UNABLE TO ADJUST X-TALK PROPERLY TIC & TCEPT.
CHANGE 2. UNABLE TO ADJUST CAL IN TI 2 dB OFF.

PHILCO



PHILCO-FORD CORPORATION
Semi Electronic Operation
Menlo Park, California • 94025

→	1			907307500	RES	750Ω 1/8 W 1%	R13
	1			27 907301050	RES,	105Ω, 1/8 W, 1%	R49
	4			26 907364R90	↑	64.9Ω, 1/8 W, 1%	R52,62
				26			43,51
	6			25 907376R80		76.8Ω, 1/8 W, 1%	R49,51,43, 57,52,62
→	1			24 907301500		150.Ω 1/8 W, 1%	R65
	1			23 907301050		105.0Ω, 1/8 W, 1%	R57
→	~~1~~ 1			22 907300750		75.0Ω, 1/8 W 1%	R63, ~~55~~
	3 3			21 906900101		100Ω, 1/4 W, 5%	R25,35,71
	4 4			20 907302100		210Ω, 1/8 W, 1%	R22,24
				20			33,34
	2 2			19 906900222		2.2K, 1/4 W, 5%	R21,32
	6 6			18 907306810		681Ω, 1/8 W, 1%	R19,20,23
				18			28,30,31
	2 2			17 907303481		3.48K, 1/8 W, 1%	R18,27
		1 1		16 907900316		5K, 10% POT	R14
1	~~1~~ 1			15 907301001		1K, 1/8 W, 1%	R12, ~~18~~
	1			14 907301370		137Ω, 1/8 W, 1%	R10
	1			13 907305490		549Ω, 1/8 W, 1%	R9
	1			12 907304991		4.99K, 1/8 W, 1%	R8
	1			11 907302741		2.74K, 1/8 W, 1%	R7
				10 907900288		2K, 15T, POT	R6
	1			9 907325R50		25.5Ω, 1/8 W, 1%	R5
	3 3			8 906900102		1K, 1/4 W, 5%	R4,11,17
	5 5			7 906900202		2K, 1/4 W, 5%	R3,15,16
				7			26,36
		1 1		6 907900338	1	50K, 10%, 15T POT	R2
	1			5 907301002	RES,	10K, 1/8 W, 1%	R1
	~~1~~	1		4 A03265408	A7 PWB ASSY SEQUENCE		
~~1~~		1		3 A03265409	A7 PWB ASSY SEQUENCE		
		1		2 904500682	A7 PWB (C03265600)		
		REF	REF	1 D03265500	PWB ASSY		

QTY	QTY	QTY	QTY	ITEM	DWG. NUMBER	DESCRIPTION
09	08	02	01			LIST OF MATERIAL

ECO 20089 2/21/89 SHEET 2 OF 4	DRAWN BY	DATE	TITLE A7 PWB ASSY L/M		
	C	6/19/77			
	CHECKED BY		SIZE CODE IDENT. NO. DWG. NUMBER REV.		
	B. CARLSON	7/2			
APPROVED BY		A	94668	A03265400	N1
REL. FOR PROD.		SCALE	SHEET 2 OF 6		

ISSUED TO: Ed Mizuno

CAR ISSUED: 2/15/89
(DATE)

DUE DATE:

Q. A. MANAGER

INFO CY'S TO: Russ Davis

Lee Maes

CAR CLOSED:
(DATE)

Q. A. MANAGER

PROBLEM OR DEFECT STATED AS FOLLOWS:

PART/MODEL NO: 413A-11

DESCRIPTION: A7 Brd

PO/WO/JOB NO:

REFERENCES: D03266800
A03265400**PRIORITY—ACTION REQUIRED IMMEDIATELY**413A-11

Unable to adjust CAL in T1 (R66-A7 Brd), 2 dB off.

Request R65 - A7 brd be changed to 150 OHM (907301500)
to allow for proper range.

Schematic - D03266800

L/M - A03265400

SIGNATURE AND DATE

Q. E.'S RECOMMENDATION FOR CORRECTIVE ACTION IS:

Please correct.

SIGNATURE AND DATE

CORRECTIVE ACTION TAKEN: (TO BE COMPLETED BY ADDRESSEE - ATTACH SHEETS AS NECESSARY.)

SIGNATURE AND DATE

Q. A. ENGINEERING EVALUATION

- ☐ SATISFACTORY - RETURNED TO Q. A. MANAGER FOR CLOSURE
☐ FOLLOW UP REQUIRED ☐ FOLLOW UP SATISFACTORILY COMPLETED
☐ UNSATISFACTORY - RETURNED TO Q. A. MANAGER FOR RESUBMISSION

SIGNATURE AND DATE

EO 20839
2/21/89
SHEET 3 OF 4

ISSUED TO: <u>Ed Mizuno</u>		CAR ISSUED: <u>2/15/89</u> (DATE)	
DUE DATE: _____		<u>Sally Spurgeon</u> Q. A. MANAGER	
INFO CY'S TO: <u>Russ Davis</u> <u>Lee Maes</u>		CAR CLOSED: _____ (DATE)	
		Q. A. MANAGER	
PROBLEM OR DEFECT STATED AS FOLLOWS:		PART/MODEL NO: <u>413A & 413A-11</u>	
PRIORITY-ACTION REQUIRED IMMEDIATELY		DESCRIPTION: <u>A7B</u>	
		PO/WO/JOB NO: _____	
		REFERENCES: <u>D03266800</u> <u>A03265400</u>	
413A & 413A-11			
Unable to adjust X-Talk properly (TIC & TCEPT).			
Request R13 Be changed to 750 ohm (907307500)			
Schematic - D03266800			
L/M - A03265400		<u>Sally Spurgeon</u> SIGNATURE AND DATE	
Q. E.'S RECOMMENDATION FOR CORRECTIVE ACTION IS:			
Please correct.			
SIGNATURE AND DATE			
CORRECTIVE ACTION TAKEN: (TO BE COMPLETED BY ADDRESSEE - ATTACH SHEETS AS NECESSARY.)			
SIGNATURE AND DATE			
Q. A. ENGINEERING EVALUATION			
☐ SATISFACTORY - RETURNED TO Q. A. MANAGER FOR CLOSURE			
☐ FOLLOW UP REQUIRED ☐ FOLLOW UP SATISFACTORILY COMPLETED			
☐ UNSATISFACTORY - RETURNED TO Q. A. MANAGER FOR RESUBMISSION			
SIGNATURE AND DATE			



ENGINEERING CHANGE ORDER
ENGINEERING VARIANCE ORDER
TYPE 1 CHANGE ORDER

AUTO INSERT AFFECTED ☐ Y ☒ N

NUMBER 2118
DATE May 3, 1990
SHEET 1 OF 1

EFFECTIVITY		JOBS AFFECTED	MODELS AFFECTED	AFFECTED DOCUMENT		CHANGE REV.			
MODEL	S/N OR DATE			DOCUMENT NUMBER	DESCRIPTION	FROM	TO		
413A	May 3, 1990	J604	413A	AO3539800	FRONT PANEL ASSY LHM	D	D		
A. SUMMARY MFG. COST OF CHANGE \$ <u>0</u>									
B. EXPECTED MFG. CHANGE ☐ HIGHER ☐ LOWER									
C. PERFORMANCE ☐ YES ☐ NO									
D. APPEARANCE ☐ YES ☐ NO									
E. INTERCHANGEABILITY ☐ YES ☐ NO									
F. SCHEDULE ☐ YES ☐ NO									
G. JOBS ☐ YES ☐ NO									
H. BOM ☐ YES ☐ NO									
J. TOOLING ☐ YES ☐ NO									
K. VISUAL AIDS ☐ YES ☐ NO									
L. OPERATION SHEET ☐ YES ☐ NO									
M. TEST PROCEDURE ☐ YES ☐ NO									
N. MANUAL ☐ YES ☐ NO									
P. PUBLISHED DATA ☐ YES ☐ NO									
R. 3060 ☐ YES ☐ NO									
DISPOSITION CODE		PART NO.	DISPOSITION	STOCK	W.I.P.	TEST	COMPLETE	ON ORDER	CUST SERV
1. INCORPORATE CHANGE		AO3539800	1	3	1	3	3	1	3
2. SCRAP			COST						
3. USE AS IS									
CODE X		DATE	CODE Y	DATE	CODE Z		ORIG. BY	5-9-90	
ENGR		5/9/90	ENGR				Walt K.		
MFG. ENG		5/9/90	SALES				INC. BY		
QA		5/9/90	MKT				CHK. BY	CW	
DOC CONTROL		5/10/90	OPER	5/9/90	CLASSIFICATION CODE		A	AC	AR
					REF. MFG. REQUEST			NUMBER	
								2118	

USE 907900358 IK POT IN PLACE OF ITEM 21 907900129 IK POT

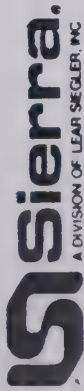
FOR JOB J604 AS NEEDED. USE THE FOLLOWING CONFIGURATION FOR WIRING.

NOTE: B720 LOCATING TAB DOWN SLIGHTLY TO INSERT INTO TAB HOLE AND ADJ. ROUTING OF HARNESS IF NECESSARY.

*FIELD RETROFIT REQUIRED YES ☒ NO ☐ P.I.M. 123, EST. COST 123, S/N 123, TO 123

REASON FOR CHANGE: DELIVERY DATE FOR 907900129 WAS DELAYED AND WOULD BE HERE ON TIME TO MEET SHIPPING SCHEDULE.

* REAR VIEW.



A DIVISION OF LEAR SEGLER, INC.

EFFECTIVITY

MODEL S/N OR DATE

413A 3801 84P

A. SUMMARY MFG. COST

OP. CHANGE \$ 600

B. EXPECTED MLB CHANGE

\$ 0 HIGHER

LOWER

AFFECTED YES NO

C. PERFORMANCE

D. APPEARANCE

E. INTERCHANGEABILITY

F. SCHEDULE

G. JOBS

H. BOM

J. TOOLING

K. VISUAL AIDS

L. OPERATION SHEET

M. TEST PROCEDURE

N. MANUAL

P. PUBLISHED DATA

R. 3060

DISPOSITION CODE

1. INCORPORATE CHANGE

2. SCRAP

3. USE AS IS

CODE X

ENGR

MFG. ENG

QA

DOC CONTROL

JOBS

AFFECTED

413A

MODELS

AFFECTED

413A

DOCUMENT NUMBER

AO3276700

DO3276800

DO3292100

DO3267000

DESCRIPTION

POWER SUPPLY PANEL LM

POWER SUPPLY PANEL

POWER PANEL HARNESS

INTERCONNECT DIAGRAM

CHANGE REV.

FROM TO

09 H

01 F

02 C

03 G

CHANGE ABOVE DWGS AS SHOWN PER SHTS 3-6

* SEE Rework SH. 2

FIELD RETROFIT REQUIRED YES NO ☒ P/LM EST. COST TO

REASON FOR CHANGE TRANSISTOR MJE2455 (910302455) HAS

BECOME OBSOLETE. MJE2455T IS THE REPLACEMENT.

DIFFERENT CASE STYLE TO-18 VS TO-220, PINS 143 REVERSED

PART NO. DISPOSITION STOCK TEST COMPLETE ON ORDER CUST SERV

AO3276700 1/1 3/1 1/1

DO3292100 1/1 3/1 1/1

DATE 5/11/90

ENGR

DATE 5/14/90

MFG. ENG

DATE 5/14/90

QA

DATE 5/18/90

DOC CONTROL

ORIG. BY

INC. BY

CHK. BY

NUMBER

21185

* REWORK INSTRUCTIONS - D03292100 WIRING HARNESS

1. REMOVE WHITE CONNECTOR 'P10'
2. REMOVE THE 3 PINS (914800200) FROM 'P10' WIRES AND INSTALL NEW 914800250 PINS IN THEIR PLACE.
3. INSTALL 1 CONNECTOR (~~914800272~~) AS THE NEW 'P10' WITH WIRING AS SHOWN PER SHT 5 (VIEW B-B).

* NOTE: IF CONNECTOR 914800272 IS NOT AVAILABLE USE 914800350 IN ITS PLACE.

** CUST. SERV. - THERE WILL BE ~~8~~ 910302955 TRANSISTORS AVAILABLE FOR REPAIR OF A13A's (101-3800) AND ALL OF 3030's.

PHILCO

PHILCO-FORD CORPORATION
Sierra Electronic Operation
Menlo Park, California • 94025

AR	31	8136-0006	WIRE, 22 AWG BLU	
AR	30	8136-0005	WIRE, 22 AWG GRN	
AR	29	8136-0004	WIRE, 22 AWG YEL	
	28			
2	27	807501007	NUT, 4-40 HEX	
4	26	819204021	WASHER, #6 SPLIT LOCK	
2	25	819204019	WASHER, #4 SPLIT LOCK	
2	24	816504012	WASHER, #4 FLAT	
2	23	819204017	WASHER, #2 SPLIT LOCK	
1	22	917300501	WASHER, INSULATING SHOULDER	
1	21	917300511	WASHER, SPRING #4	
4	20	800004166	SCREW, 6-32 X 5/8	
	19			
1	18	800004086	SCREW, 4-40 X 3/8	
2	17	800004029	SCREW, 2-56 X 1/4	
	16			
1	15	915100147	INSULATOR, SILPAD	
2	14	914200051	SOCKET T03	
1	13	918400013	LUG	E1
2	12	914800244	TERMINAL	
1	11	914800243	CONNECTOR 2 PIN RECEPTACLE	J9
1	10	910800025	RECTIFIER BRIDGE	CR3
2	9	910804385	DIODE 1N4385	CR1, CR2
1	8	910302955	TRANS. MJE-2955T	Q1
1	7	906203R00	RES. 3Ω, 5W, 3%	R1
1	6	920300340	VOLT. REG. LM 340K	VR2
1	5	920300317	VOLT. REG. LM 317K	VR1
2	4	915100252	INSULATOR, SILPAD (T0-3)	
1	3	D03292100	HARNESS ASSY, POWER PNL	
1	2	C03274400	POWER PANEL	
REF	1	D03276800	POWER PANEL ASSY	

QTY	QTY	QTY	QTY	ITEM	DWG. NUMBER	DESCRIPTION
-----	-----	-----	-----	------	-------------	-------------

LIST OF MATERIAL

DRAWN BY SCURIALE		DATE 6/27		TITLE POWER SUPPLY PANEL L/M			
CHECKED BY BCARLSON		7/11					
APPROVED BY				SIZE A	CODE IDENT. NO. 94668	DWG. NUMBER A03276700	REV G
REL FOR PROD.				SCALE		SHEET 2 OF 2	

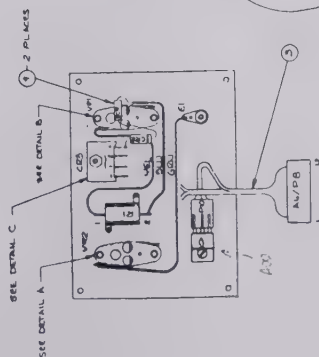
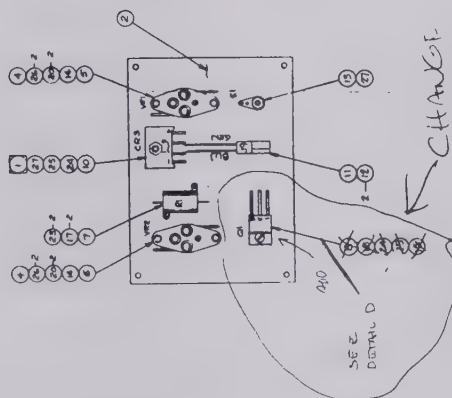
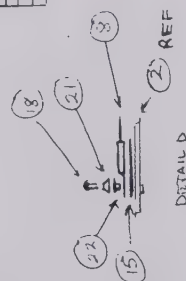
SHF 3046
ECO # 21185

58110003

FOR REFERENCE USE

May 10 1990

UNIT	DESCRIPTION	DATE	INITIALS
A	PLOT RUN: RELEASE	7/1	W
A	PCO 2408	7/1	W
B	PRODUCTION RELEASE	7/1	W
B	ECO 17944 A	7/1	W
C	ECO 17945	7/1	W
D	PER ECO ROOM	7/1	W
E	PER ECO 1015	7/1	W



NIRE SOLAR						
DATE	TIME	COLOR	ITEM	REMARKS	TO	REMARKS
1	10:00	BLK	WV-1		CR10	TRAC SOLAR
2	10:05	DEN	WV-2		CR10	TRAC SOLAR
3	10:10					
4	10:15					
5	10:20	BLU	WV-3	REV-1	VR-1	TRAC SOLAR
6	10:25	GRN	WV-4	REV-2	VR-2	TRAC SOLAR
7	10:30	GRN	WV-5	REV-3	VR-3	TRAC SOLAR
8	10:35	YLO	WV-6	REV-4	VR-4	TRAC SOLAR
9	10:40	GRN	WV-7	REV-5	VR-5	TRAC SOLAR
10	10:45	GRN	WV-8	REV-6	VR-6	TRAC SOLAR
11	10:50	GRN	WV-9	REV-7	VR-7	TRAC SOLAR
12	10:55	GRN	WV-10	REV-8	VR-8	TRAC SOLAR
13	11:00	GRN	WV-11	REV-9	VR-9	TRAC SOLAR
14	11:05	GRN	WV-12	REV-10	VR-10	TRAC SOLAR
15	11:10	GRN	WV-13	REV-11	VR-11	TRAC SOLAR
16	11:15	GRN	WV-14	REV-12	VR-12	TRAC SOLAR
17	11:20	GRN	WV-15	REV-13	VR-13	TRAC SOLAR
18	11:25	GRN	WV-16	REV-14	VR-14	TRAC SOLAR
19	11:30	GRN	WV-17	REV-15	VR-15	TRAC SOLAR
20	11:35	GRN	WV-18	REV-16	VR-16	TRAC SOLAR
21	11:40	GRN	WV-19	REV-17	VR-17	TRAC SOLAR
22	11:45	GRN	WV-20	REV-18	VR-18	TRAC SOLAR
23	11:50	GRN	WV-21	REV-19	VR-19	TRAC SOLAR
24	11:55	GRN	WV-22	REV-20	VR-20	TRAC SOLAR
25	12:00	GRN	WV-23	REV-21	VR-21	TRAC SOLAR
26	12:05	GRN	WV-24	REV-22	VR-22	TRAC SOLAR
27	12:10	GRN	WV-25	REV-23	VR-23	TRAC SOLAR
28	12:15	GRN	WV-26	REV-24	VR-24	TRAC SOLAR
29	12:20	GRN	WV-27	REV-25	VR-25	TRAC SOLAR
30	12:25	GRN	WV-28	REV-26	VR-26	TRAC SOLAR
31	12:30	GRN	WV-29	REV-27	VR-27	TRAC SOLAR
32	12:35	GRN	WV-30	REV-28	VR-28	TRAC SOLAR
33	12:40	GRN	WV-31	REV-29	VR-29	TRAC SOLAR
34	12:45	GRN	WV-32	REV-30	VR-30	TRAC SOLAR
35	12:50	GRN	WV-33	REV-31	VR-31	TRAC SOLAR
36	12:55	GRN	WV-34	REV-32	VR-32	TRAC SOLAR
37	1:00	GRN	WV-35	REV-33	VR-33	TRAC SOLAR
38	1:05	GRN	WV-36	REV-34	VR-34	TRAC SOLAR
39	1:10	GRN	WV-37	REV-35	VR-35	TRAC SOLAR
40	1:15	GRN	WV-38	REV-36	VR-36	TRAC SOLAR
41	1:20	GRN	WV-39	REV-37	VR-37	TRAC SOLAR
42	1:25	GRN	WV-40	REV-38	VR-38	TRAC SOLAR
43	1:30	GRN	WV-41	REV-39	VR-39	TRAC SOLAR
44	1:35	GRN	WV-42	REV-40	VR-40	TRAC SOLAR
45	1:40	GRN	WV-43	REV-41	VR-41	TRAC SOLAR
46	1:45	GRN	WV-44	REV-42	VR-42	TRAC SOLAR
47	1:50	GRN	WV-45	REV-43	VR-43	TRAC SOLAR
48	1:55	GRN	WV-46	REV-44	VR-44	TRAC SOLAR
49	2:00	GRN	WV-47	REV-45	VR-45	TRAC SOLAR
50	2:05	GRN	WV-48	REV-46	VR-46	TRAC SOLAR
51	2:10	GRN	WV-49	REV-47	VR-47	TRAC SOLAR
52	2:15	GRN	WV-50	REV-48	VR-48	TRAC SOLAR
53	2:20	GRN	WV-51	REV-49	VR-49	TRAC SOLAR
54	2:25	GRN	WV-52	REV-50	VR-50	TRAC SOLAR
55	2:30	GRN	WV-53	REV-51	VR-51	TRAC SOLAR
56						

FOR LIST OF MATL SEE A03276700

[illegible]

PART NO	COLOR	WIRE CUT LIST			REMARKS
		GAUGE	LENGTH	QTY	
8131-0000	PEL	22	8.75	1	666 WOTE 2
8131-0000	GRN	22	2.50	1	666 WOTE 4
8131-0000	GRN	22	5.50	1	666 WOTE 2
8131-0000	BLU	22	2.50	1	666 WOTE 3
8131-0000	BLU	22	8.75	1	666 WOTE

22

UNIT TERMINAL POSTS OF CFS
TO 26 IN 1000.

90.25 IN LONG.

1. STROD WAZES BACK 250 W. WALLS
ATTENDING. NOTED.

OFFICIALS OF THE BUREAU OF THE
CENSUS OF THE UNITED STATES

9. STOPPED WHEELS AT COLLECTION OF
BACK FEB 11.

THE NEW YORK PUBLIC LIBRARY

4

8	7
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100

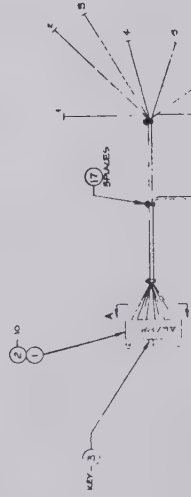
ECO 4 2/25 5475 506

FOR REFERENCE USE ONLY
MAY 10 1990

DATE	DESCRIPTION
1	BLT W/IN RELEASE
2	A PRODUCTION RELEASE
3	AL ECO 17544
4	AL PER ECO 10542
5	AL PER ECO 10542
6	AL PER ECO 10542
7	AL PER ECO 10542
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97	AL PER ECO 10542
98	AL PER ECO 10542
99	AL PER ECO 10542
100	AL PER ECO 10542

TERMINAL NO.	WIRE COLOR	FROM	TERMINAL NO.	TO	REMARKS
1	BLK	WIRE 1	1	1	
2	BLK	WIRE 2	2	2	
3	BLK	WIRE 3	3	3	
4	BLK	WIRE 4	4	4	
5	BLK	WIRE 5	5	5	
6	BLK	WIRE 6	6	6	
7	BLK	WIRE 7	7	7	
8	BLK	WIRE 8	8	8	
9	BLK	WIRE 9	9	9	
10	BLK	WIRE 10	10	10	
11	BLK	WIRE 11	11	11	
12	BLK	WIRE 12	12	12	
13	BLK	WIRE 13	13	13	
14	BLK	WIRE 14	14	14	
15	BLK	WIRE 15	15	15	
16	BLK	WIRE 16	16	16	
17	BLK	WIRE 17	17	17	
18	BLK	WIRE 18	18	18	
19	BLK	WIRE 19	19	19	
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21	BLK	WIRE 21	21	21	
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29	BLK	WIRE 29	29	29	
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94	BLK	WIRE 94	94	94	
95	BLK	WIRE 95	95	95	
96	BLK	WIRE 96	96	96	
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98	BLK	WIRE 98	98	98	
99	BLK	WIRE 99	99	99	
100	BLK	WIRE 100	100	100	

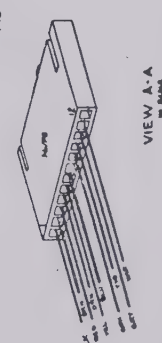
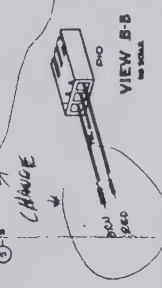
WIRE NO.	WIRE COLOR	WIRE SIZE	WIRE LENGTH	WIRE TYPE	REMARKS
1	BLK	22	6.50	1	
2	BLK	22	6.50	2	
3	BLK	22	6.50	3	
4	BLK	22	6.50	4	
5	BLK	22	6.50	5	
6	BLK	22	6.50	6	
7	BLK	22	6.50	7	
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68	BLK	22	6.50	68	
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70	BLK	22	6.50	70	
71	BLK	22	6.50	71	
72	BLK	22	6.50	72	
73	BLK	22	6.50	73	
74	BLK	22	6.50	74	
75	BLK	22	6.50	75	
76	BLK	22	6.50	76	
77	BLK	22	6.50	77	
78	BLK	22	6.50	78	
79	BLK	22	6.50	79	
80	BLK	22	6.50	80	
81	BLK	22	6.50	81	
82	BLK	22	6.50	82	
83	BLK	22	6.50	83	
84	BLK	22	6.50	84	
85	BLK	22	6.50	85	
86	BLK	22	6.50	86	
87	BLK	22	6.50	87	
88	BLK	22	6.50	88	
89	BLK	22	6.50	89	
90	BLK	22	6.50	90	
91	BLK	22	6.50	91	
92	BLK	22	6.50	92	
93	BLK	22	6.50	93	
94	BLK	22	6.50	94	
95	BLK	22	6.50	95	
96	BLK	22	6.50	96	
97	BLK	22	6.50	97	
98	BLK	22	6.50	98	
99	BLK	22	6.50	99	
100	BLK	22	6.50	100	



NOTES:
1. STRIP WIRES BACK 250 IN.
UNLESS OTHERWISE SPECIFIED.
2. AT P.O. 1. AUPB.

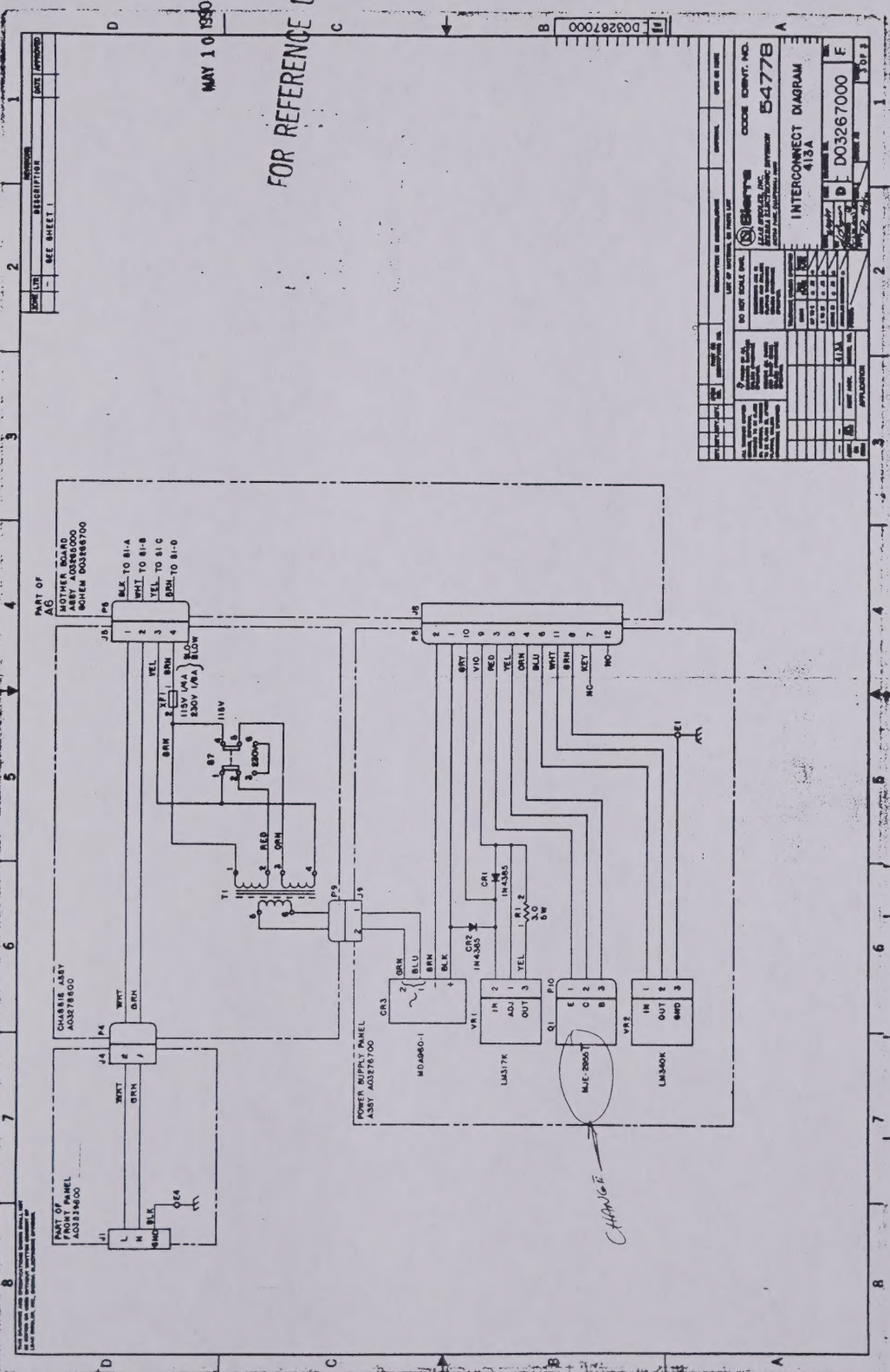
NOTE
ITEMS 1-2 ARE IN THE
ARE BUNDLED TOGETHER ON PRE-SORTED

914800272



DATE	DESCRIPTION
1	BLT W/IN RELEASE
2	A PRODUCTION RELEASE
3	AL ECO 17544
4	AL PER ECO 10542
5	AL PER ECO 105

MAY 10 1990



FOR REFERENCE USE ONLY

MAY 10 1950

Siemens CODE SENT. NO. **54778**
LEAS STOLER, INC.
STRAL ELECTRONIC DIVISION
CROFT AVE. ALBANY, N.Y.

INTERCONNECT DIAGRAM
413A

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72 46	1	Top 1
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ACCOPRESS®

25970	YELLOW
25971	BLACK
25972	LIGHT BLUE
25973	DARK BLUE
25974	LIGHT GRAY
25975	LIGHT GREEN
25976	DARK GREEN
25977	TANGERINE
25978	RED
25979	EXECUTIVE RED

GENUINE PRESSBOARD

ACCO®



ACCO USA, INC.
770 S. ACCO PLAZA
WHEELING, IL 60090

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